

**Exploring a Paradigm Shift: An Australian Case Study
of the Adoption of Multimedia Occupational Health,
Safety and Environment Inductions**

By

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This thesis is presented for the degree of Doctor of Philosophy
of Murdoch University 2011

I declare that this thesis is my own account of my research:

Rodger Wright:

ABSTRACT

Despite research suggesting the superiority of face-to-face communication in the transmission of vital information and contrary to the lack of productivity/profitability evidence for IT in general and multimedia in particular, classroom style Occupational Health, Safety and Environment (OHSE) inductions in Australia are increasingly being replaced by interactive multimedia. The research described in this thesis investigates this trend. On the practitioner side, it contributes to the knowledge base of OHSE and multimedia professionals and practitioners by describing the paradigm shift to the use of multimedia in OHSE inductions. The research describes current practice including the delivery media and content of the inductions. On the theoretical front, this research uses the data collected in achieving the practice-oriented objective to test theoretical aspects of the paradigm shift to the use of multimedia in OHSE inductions. Case study data was collected from 21 adopting organisations that were paired across industry sectors. The data included personal interviews with the OHSE managers and analysis of their multimedia OHSE inductions. A number of theoretical platforms were tested including Technology Push/Market Pull, Unique Selling Propositions (USP), Product Positioning, the Technology Acceptance Model (TAM2), Media Richness Theory (MRT), the Productivity-Profitability Paradox (PPP) and the role of Disruptive and Revolutionary technologies in paradigm shifts. Adoption by others (the ‘herd’), Demonstratability, Job Relevance, Image and Output Quality were identified as important change factors. The PPP was both contradicted and supported – multimedia was found to be very cost effective, but on the other hand ‘profits’ were traded away before they hit the bottom line. Major factors in influencing enterprises to ‘take the leap’ were transaction efficiency (more inductions, employing less infrastructure, delivered in less time) and the superior consistency of multimedia delivery.

Keywords: Occupational Health, Safety, Environment, Paradigm Shift, Multimedia, Technology-Push, Market-Pull, USP, Product Positioning, Technology Acceptance Model, TAM, Media Richness Theory, MRT, Duty of Care, DOC, Productivity Paradox, Profitability Paradox, Information Productivity, Transaction Efficiency

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ACKNOWLEDGEMENTS

This research was only made possible by the co-operation, sharing of experiences and expertise provided by the case study participants and the owners and staff of The Multimedia Company – all done in the name of benefitting their fellow practitioners.

As a youth, I was unable to attend university. I instead fulfilled my military obligations where I discovered and worked on some early value computers. After a lifetime in computing and IT, I approached Murdoch University with the thought of doing some research. I wish to thank Assoc. Professor Dr. Lance Fung for providing me with the opportunity to qualify for the Masters by Coursework and Research program that eventually led to this thesis.

I wish to express my deep appreciation and thanks to my principal supervisor, Assoc. Professor Dr. Tanya McGill, for her wise guidance and council, more than generous donation of time and effort and most of all for her unfailing dedication to academic excellence. If this work is of any academic value, much of that credit must be given to her almost magical transformation of a business report writer into an academic thesis author.

My wife missed her calling to become a veterinary doctor because at the time a girl could only become a teacher, a nurse or an office worker. Without her prompting, encouragement and continued support, this work would never have been commenced or completed – thanks sweetie.

Graduating from secondary school at the height of the 1930s depression, my father was also not able to follow his dream of becoming an aeronautical engineer. The only job he could get to support his mother and invalid sister was working on a road building crew.

Lexie and Dad - this one's for you.

Chapter 1 BACKGROUND TO THE RESEARCH

1.1 INTRODUCTION

Occupational Health, Safety and Environment (OHSE) are cornerstones of modern corporate Human Resources (HR) departments. OHSE policy statements are prominently displayed on office walls and web sites, safe-working statistics are posted on billboards and OHSE accomplishments are given pride of place in corporate newsletters. Corporate OHSE departments are typically well funded and actively engaged in training, accident prevention and the monitoring of safe working practices. An example may be found in BHPBilliton Health Safety Environment and Community Reports (2002-6).

OHSE inductions are an essential OHSE practice. Prior to commencing work on most industrial sites in Australia, a visitor, contractor or new employee will be required to participate in an OHSE induction. In some instances, re-inductions are carried out on a calendar basis or when an employee or contractor has been absent from a site for an extended period (e.g. for annual or long service leave).

The purpose of an OHSE induction is to ensure an employee, contractor or visitor has an understanding of the company's OHSE policies concerning the environment, indigenous heritage, health, fitness for work (smoking, drug and alcohol testing), safety reporting, access authority, emergency procedures, special hazards, accident prevention, first aid, personal protective equipment (PPE), electrical isolation and tagging systems, permits to work and many other work and health related subjects. These jointly fall under the heading of Duty of Care (DOC). Every company has a legal DOC that reaches

all the way up from the workplace to the boardroom to ensure the safety and welfare of its employees, the community and the environment.

This thesis explores the paradigm shift that is occurring in the Australian Occupational Health, Safety and Environment industry in which classroom slide shows and printed material based inductions are increasingly being supplanted by interactive multimedia systems. This shift is investigated in terms of both professional practice and predicted versus actual theoretical outcomes.

1.2 DEFINITION OF TERMS

Definitions adopted by researchers are often not uniform or consistent and terms and acronyms unique to their context and practice may not be widely known. A definition of terms is commonly found at the beginning of a thesis. For that purpose, a short definition of the term 'multimedia' and a description of the 'OHSE induction' are included here. However, due to the large number of terms encountered in this research and in order to clarify the meaning of terms for readers new to the subject and to establish the positions taken in this thesis for the more informed readers, further definitions are presented in Appendix A and a literature review of multimedia and e-learning is contained in Chapter 2.1.

1.2.1 What is Multimedia?

Multimedia is defined as a computer-based method of presenting combinations of text, images, graphics, animation, audio and video with an emphasis on interactivity. From

this definition of multimedia, multimedia can be said to be both the ‘message’ and the ‘medium’. By this is meant that multimedia is a combination of content (the message) delivered via specific channels or domains (the medium). The message and the medium are sometimes referred to in a more formal manner as the ‘information space’ and the ‘operational environment’ (Schlossberg 1992).

1.2.2 The Traditional OHSE Induction

A traditional OHSE induction consists of a trainer, inductees, a training schedule, a training room, training materials and a competency assessment (quiz). The trainer is generally present for the duration of the induction, stands at the front of the classroom and conducts the induction in a traditional teacher-student relationship. In an ideal situation, the trainer is an experienced OHSE professional who also holds qualifications in training and has expert knowledge of the work processes.

The inductees often represent a wide cross section of educational level, ethnic background, age, gender, work experience, and trade or professional qualifications.

Inductions are generally carried out at fixed times, on specified days of the week, at fixed locations and in specific training rooms. Inductions outside these times and places may be difficult to arrange. Each venue has a finite seating capacity. Parallel inductions are seldom if ever run. Some effort may be made to conduct general work safety inductions at central locations prior to an inductee’s arrival on site.

The trainer lectures the audience, speaks to static graphics or slides and may play films or videos. In recent years, inductions have graduated from using flip charts, overhead projectors, film projectors and VCRs to using PC based slide-show programs, LCD projectors, DVD video players and flat display screens – but the format has remained essentially the same.

Training materials and induction requirements are usually multi-level. Levels may include general OHSE statements, more specific information relating to working outdoors or on a site, driving and mobile plant, tagging and permits, special hazards, and local, workplace specific orientation.

The competency assessment at the completion of the induction is usually completed as a group effort. The answers are reviewed with the inductees by the trainer and any wrong answers or questions are addressed. Upon completion of the induction, each inductee is normally issued with a security access device (a badge, swipe card or similar), their attendance is recorded in a database, but the written and signed competency assessment results are seldom retained.

Using the traditional methods, OHSE inductions can be very time consuming. A minimal visitor induction may take from one to two hours. A new employee or contractor induction generally takes not less than half a day - more commonly one to two days, and in some instances as long as four to five days. In preparation for working at an industrial site, the author was once required to complete the following OHSE inductions: Enterprise induction (one day), basic safe working course (three days), 4WD driver-training course (one day), supervisor-training course (two days), site-specific

induction (one day), and three by one hour area inductions – a total of over eight days. This was not an uncommon experience.

1.3 FOCUS AND OBJECTIVES OF THE RESEARCH

The provision of digital content in Australia is estimated to be worth in excess of \$A21 billion annually and multimedia is the fastest growing industry worldwide (Strategic Industry Leaders Group 2004). As described in Chapter 1.5, the use of multimedia for OHSE inductions in Australia has emerged as a new paradigm on which little or no research has been conducted. This research explores the paradigm shift to multimedia OHSE inductions and provides an opportunity to investigate and document both the factors and forces driving the change in practice and to test and compare a number of underlying theoretical platforms against actual outcomes.

1.3.1 Practice-Oriented Objective of the Research

The first objective of this research is practice-oriented:

To contribute to the knowledge base of OHSE and multimedia professionals and practitioners by describing the paradigm shift to the use of multimedia in OHSE inductions.

To achieve this objective, the descriptive, practice-oriented research in this thesis attempts to describe, classify and tabulate the context, content, implementation and delivery of multimedia OHSE inductions in order to provide a practice-oriented database of OHSE and multimedia applications for educators, practitioners and those

planning interventions. Figure 1-1 illustrates the overlapping areas of practice and the specific focus of this research.

The consistency of multimedia OHSE induction practice within/between industry sectors is an issue that was addressed in the selection of the case units as described in Chapter 3.8.2 and the results of which are reported in Chapter 4.4 and Chapter 5.10.

1.3.2 Theory-Oriented/Theory-Testing Objective of the Research

The second objective of this research is theory-oriented/theory-testing oriented:

To contribute to the knowledge base of academics, educators and theoreticians by using the data collected in achieving the practice-oriented objective to test theoretical aspects of the paradigm shift to the use of multimedia in OHSE inductions.

While the practice-oriented objective is important in its own right, the theory-oriented/theory-testing objective can only be achieved by reference to the adopter based descriptive data.

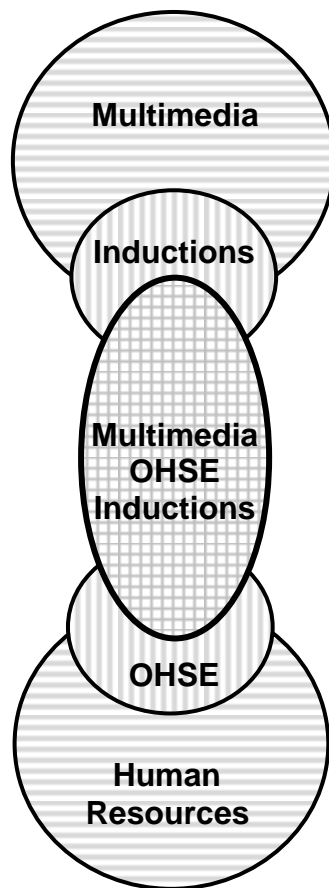


Figure 1-1 Areas of Practice

The theoretical research in this thesis explores and tests a number of theories concerning the forces, factors and influences behind the paradigm shift to multimedia OHSE inductions. Figure 1-2 illustrates the framework and linking of the theoretical themes included in this study - innovation, marketing, adoption and post adoption.

Within the general themes (innovation, marketing, adoption and post-adoption), Figure 1-3 demonstrates the overlap of the theoretical platforms and the specific focus of this study.

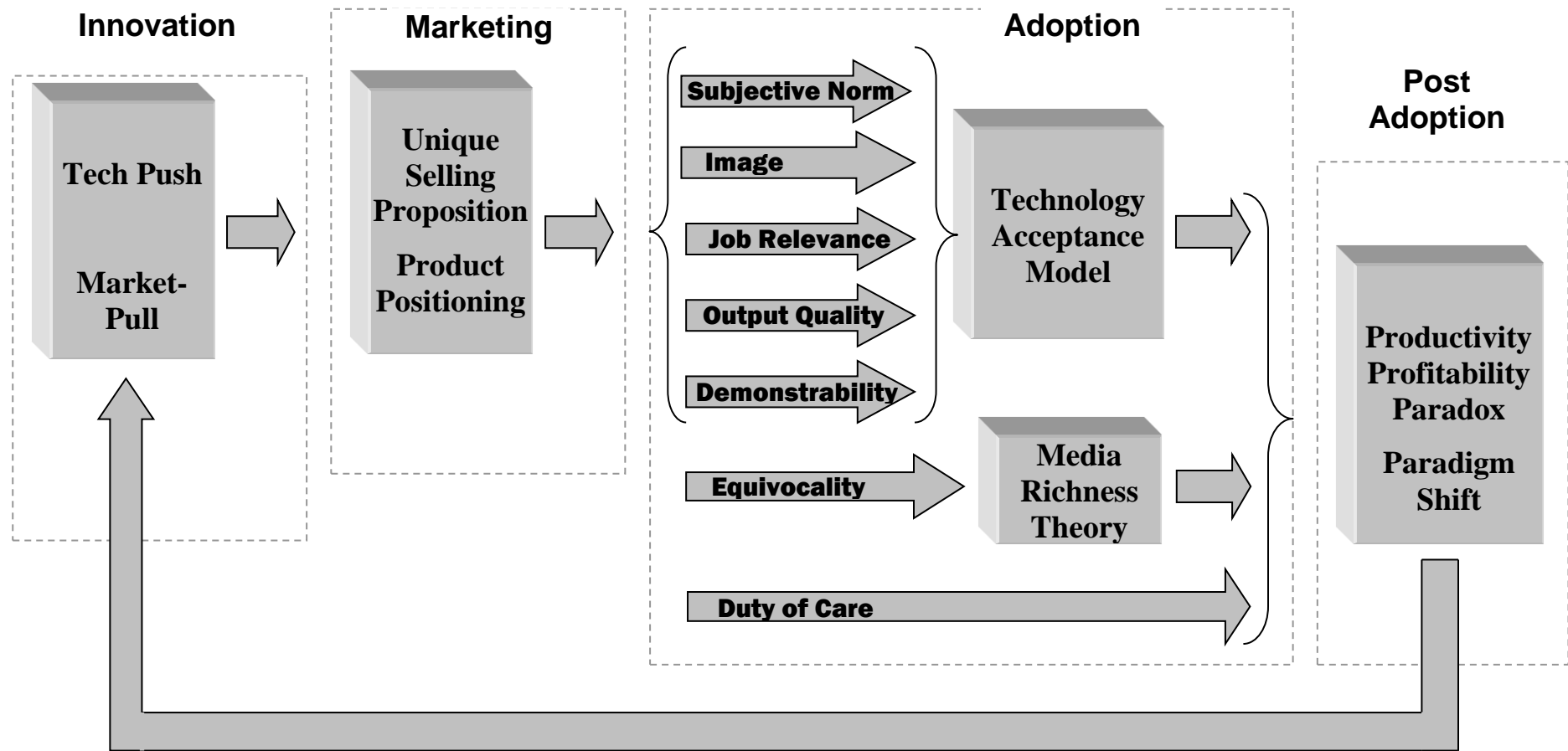


Figure 1-2 Theoretical Framework

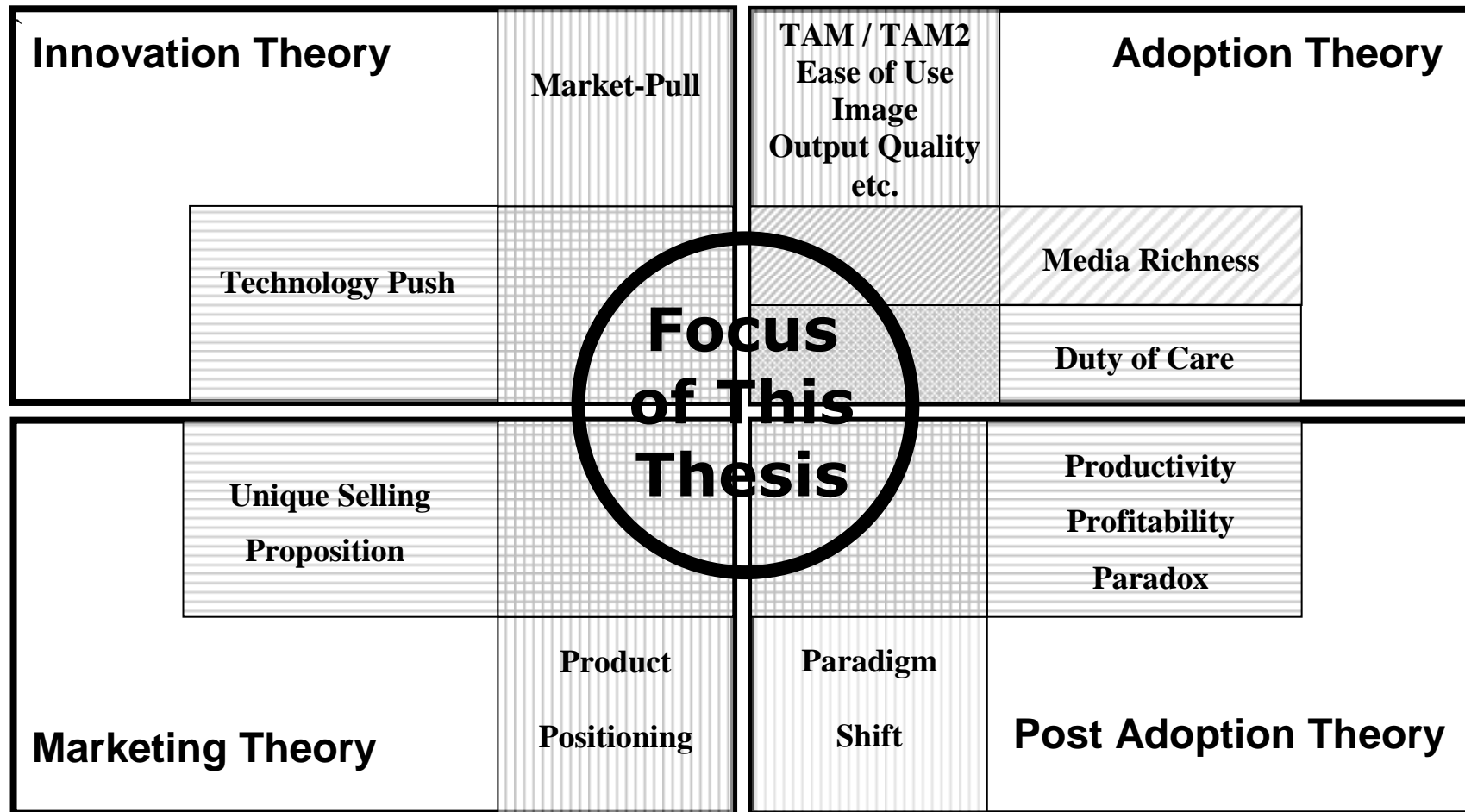


Figure 1-3 Theoretical Focus

These seven theoretical platforms are employed in either a confirmatory, explanatory or exploratory capacity – Technology-Push/Market-Pull (Rosenberg 1974), Unique Selling Proposition (USP) (Reeves 1961) and Product Positioning (Ries and Trout 1986), Technology Acceptance Model (TAM/TAM2) (Davis 1986), Media Richness Theory (MRT) (Daft and Lengel 1986), Duty of Care legislation (DOC) (Steimakowich 2004), the Productivity-Profitability Paradox (PPP) (Solow 1987) and Paradigm Shift including Disruptive Technology and Evolutionary versus Revolutionary change (Anderson 1994).

Technology-Push and Market-Pull, while capable of standing alone as theoretical issues, are grouped together as a single platform in this research. While issues concerning DOC may not technically form a ‘theoretical platform’, DOC is included under that umbrella for the sake of consistency in this research.

1.4 RESEARCH QUESTIONS

1.4.1 The Main Research Question

The main research question asks:

Q0: What factors, forces and influences are driving the technological paradigm shift from traditional OHSE inductions to multimedia?

To address this question, we must first describe and compare the traditional and multimedia implementations of OHSE inductions. With this data in hand, we may then examine theoretical aspects of the factors, forces and influences in the adoption cycle

from concept to post adoption. Each of the theoretical themes shown in the framework in Figure 1-2 - innovation, marketing, adoption and post adoption - offers the opportunity to answer a portion of the general research question Q0. Therefore, for the purposes of this research, the basic research question Q0 is divided into a number of sub-questions targeted towards implementation, innovation, marketing, adoption and post adoption.

1.4.2 Implementation

For a paradigm shift to occur, there must be a change ‘from’ one set of procedures or actions ‘to’ another (please see definitions in Appendix A and discussion in Chapter 2.8). The paradigm shift being studied is ‘from’ the traditional OHSE induction format as described in Chapter 1.2.1, and ‘to’ multimedia delivery.

In relation to the main research question Q0, we ask:

Q1.0: In what ways and in what manner are multimedia OHSE inductions being implemented? How does this differ from previous implementations?

1.4.3 Innovation

The discussion in the literature concerning provider side innovation has for a long time been focused on the Technology-Push/Market-Pull dichotomy (Rehfeld, Rennings, and Ziegler 2007). Technology-Push occurs when an innovative technology (without previous practical application) is presented to the market. Examples of Technology-Push include the optical laser and the personal computer (PC). Both were technological

marvels presented to the market with no apparent significant uses. Market-Pull occurs when the market asks for a product for which no technology exists or asks that existing technology be modified to suit a market requirement. Having examined the laser technology, the market suggested that perhaps the device could be used for extremely accurate distance measurements or to read the surface of storage devices. The CD and DVD were born. The PC (as its name implies) was marketed as a ‘personal’ computer. The market pulled word processing and table based calculations (spreadsheets) – both initially business applications.

While the initial emphasis in the literature was focused on the relative importance of Market-Pull (Schmookler 1966) versus Technology-Push (Rosenberg 1974), the later and more generally accepted picture is that technological innovation is more relevant in the initial stages of a product life-cycle with market factors becoming more important as the product matures (Pavitt 1984). Carayannis and Roy (2000) add the dynamics of Technology Pull and Market-Push to the innovation landscape and support the idea that the balance between these four forces varies over time.

In relation to the main research question Q0, we ask:

Q2.0: In what ways and to what extent have Technology-Push and Market-Pull forces been factors in the multimedia OHSE induction paradigm shift?

1.4.4 Marketing

A product is generally presented to potential clients in some manner (marketing) with some form of information describing its features and benefits (advertising). Marketing and advertising that are informative, persuasive and adequately describe solutions to the client's needs should be a factor in a product's adoption. We acknowledge that while there are many differences and distinctions made between 'advertising' and 'marketing' within their respective fields, for the purposes of this study, the terms are used synonymously.

In 1961, a giant of the advertising industry, Rosser Reeves, distilled his lifetime of knowledge concerning advertising effectiveness in the watershed book *Reality in Advertising* (Reeves 1961). In this book, Reeves describes the Unique Selling Proposition (USP) concept. USP describes a proposition that is made to a prospective adopter concerning the benefits and advantages that a product offers that competitors cannot match and that is strong enough to cause adoption. A second major advertising concept of modern marketing is Product Positioning. This concept was popularised by Al Ries and Jack Trout in their book *Positioning: the Battle for Your Mind* (Ries and Trout 1986). Product Positioning posits that the mind is constantly being assaulted with confusing information that invokes negative emotional responses – especially fear. In order to allay these emotions, products need to position themselves against other products, trusted authorities or celebrities, the 'herd' or heritage.

As the adopters in this study have taken the step of acquiring multimedia OHSE inductions, it is reasonable to assume that something 'pushed' or 'pulled' them.

In relation to the main research question Q0, we ask:

Q3.0: In what ways and to what extent have USPs and Product Positioning arguments been influential in the adoption of multimedia OHSE inductions?

1.4.5 Adoption – Technology Acceptance Model

The most widely known and accepted model of technology acceptance is the Technology Acceptance Model (TAM) (Davis 1989; Davis, Bagozzi, and Warshaw 1989). Numerous studies have shown that the TAM's twin usage constructs of perceived usefulness (PU) and perceived ease of use (PEOU) mostly or fully mediate all other influences in the intention to adopt a technology.

Other studies have found a strong correlation between intention to use and adoption which allows the confident extension of the TAM to implementation and practice (Agarwal and Prasad 1999; Chau 2001; Igbaria, Guimaraes, and Davis 1995; Igbaria et al. 1997).

Despite the TAM's success in explaining the broad beliefs associated with technological adoption, its weakness lies in its lack of specificity in identifying the actual usages that determine the significance of adoption. While the TAM shows that technology is adopted because it is useful, it says nothing about what those uses might be. An expanded version of the TAM, dubbed TAM2, was proposed to integrate and combine the social influence such as the Subjective Norm and Image constructs (the perceived

social pressure to perform as others do) with the utilitarian (PU, PEOU) theories (Venkatesh and Davis 2000). TAM2 addresses the antecedents of PU, but again only in terms of broad, pre-adoption, belief based constructs.

Both Venkatesh (1998) and Davis (1989) concede that a better understanding of usefulness would enable researchers to design organisational interventions and increase user acceptance and usage of systems. Neither the TAM nor the TAM2 provides individual target areas of reference for those interested in addressing implementation or practice. While it may be accepted as axiomatic that multimedia is being adopted in OHSE inductions because it is useful, it does not provide information as to *how* it is useful? Or *why* it is useful? Or for *what* it is being used? While Penicillin may be said to be useful and easy to use in saving lives, without some reference to dosage, administration and susceptible diseases, that information is almost valueless.

One of the aims of this research is to gain insights into the pre and experience. The variables moderated by pre-adoption PU as well as post-adoption PEOU are therefore included in the following research question and are reported in Chapter 5. PU as a pre-adoption belief is not explicitly included in the research but post-adoption usefulness is the subject of research Q1.0 and is investigated and reported in Chapter 4. Please see Chapter 2.4.10 for a discussion of the pre and post-adoption domains.

Davis (1989) was the first to show that PU and PEOU were strongly correlated to future adoption. In the post adoption domain, these pre-adoption beliefs translate to implementation success and actual ease of use. Plans for future adoption are therefore a

good measure of the success of multimedia OHSE inductions and are included in the following research question.

In relation to the main research question Q0, we ask:

Q4.1 To what extent have multimedia OHSE inductions been easy to use?

Q4.2 In what ways and to what extent have Subjective Norm, Image, Job Relevance, Output Quality and Demonstratability been influences in the adoption of multimedia OHSE inductions?

Q4.3 What is the intent for future adoption of multimedia OHSE inductions?

1.4.6 Adoption – Media Richness Theory

‘Why do organisations process data?’ The answer most commonly given in the literature is that they are attempting to reduce uncertainty (Weick 1976). By collecting more data, managers are able to base decisions on reduced uncertainty. ‘Why do organizations train?’ The answer most commonly given in the literature is to reduce equivocality. In the face of equivocal or ambiguous situations, the collection of additional data alone will not help reduce uncertainty. Managers therefore create or define general solutions to equivocality and then attempt to pass them on to employees in the form of training (Daft and Lengel 1986). OHSE inductions are a classic case of this solution – the inductions attempt to remove uncertainty and equivocality about certain OHSE related behaviors and actions.

The question that immediately follows is ‘What media best dispels uncertainty and equivocality?’ Daft and Lengel (1986, 1987) proposed the Media Richness Theory (MRT) to explain such decisions. This theory posits that managers select a media for communication based on the ability of the media to avoid equivocality. The perceived ability of media to overcome equivocality is based on its ‘richness’. Richness is defined as the ability of a media to change understanding within a time interval (Daft and Lengel 1986, p. 560). Richness factors include feedback, multiple clues, language variety and personal focus. On the richness scale, face-to-face with its ability to contain many social clues and the opportunity for immediate feedback is rated highest with numeric documents rating lowest.

This study provides the opportunity to examine the choice of media made by a group of adopters who have a message to deliver where equivocality is of high, possibly life-threatening importance. The adopters chose multimedia over face-to-face delivery. According to MRT, the adopters chose multimedia because it was a richer media, better able to dispel uncertainty and reduce equivocality.

In relation to the main research question Q0, we ask:

Q5.0: In what ways and in what manner is multimedia better able to dispel uncertainty and reduce equivocality as compared to face-to-face delivery of OHSE inductions?

1.4.7 Adoption – Duty of Care Legislation

The legal principle of Duty of Care (DOC) is drawn from both the Australian common and statute law (Cassidy 1995). It imposes on those responsible, especially company directors, a duty to conduct the affairs of the company with due care and diligence towards both its stockholders and employees. The DOC concept extends beyond company directors to managers, individual practitioners, financial auditors, financial consultants and insurers (Wright 2004). DOC legislation similar to that in Australia has been passed in the U.K., Canada and New Zealand (Steimakowich 2004). Parallels can be drawn between DOC legislation in these ‘common law’ countries and the Sarbanes-Oxley legislation in the U.S.A.

DOC legislation is affecting business in Australia at all levels. An objective of this research is to determine the impact of DOC requirements on the introduction of OHSE inductions.

In relation to the main research question Q0, we ask:

Q6.0: In what ways and to what extent has DOC been a factor in the adoption of multimedia OHSE inductions?

1.4.8 Post Adoption – Productivity-Profitability Paradox

The profitability paradox was originally posed by economist and Nobel Laureate Robert Solow who observed ‘You can see the computer age everywhere but in the productivity statistics.’ (1987, p. 36). This insight sparked what may be the world’s largest and

longest line of IT/economic research. Over twenty years later, papers are still being published at the rate of about one per month (2006-2009, Proquest & Science Direct). Many follow-up studies have failed to find any significant productivity-profitability gains associated with investment in IT and have upheld the PPP at the international, nation, industry and firm levels. Chapter 2.7 contains an extensive review of the debate concerning the existence of the PPP and its possible explanations and alternatives. One of most appealing of the explanations of the PPP is the Redistribution explanation which speculates that 'profits' and benefits from investment in IT are often traded before reaching 'the bottom line'.

When examining multimedia specifically, the profitability outlook is even worse than for IT investment in general. Fahy (2004) cites multiple sources (listed in Chapter 2.7) as determining that a) the Total Cost of Ownership (TCO) of multimedia will constantly rise, b) no general cost savings may ever be realised by most users, c) the TCO will be well above purchase price by many times, d) the rationale for adopting multimedia is more related to issues of technical performance, flexibility, improved learning and user satisfaction than cost effectiveness. An alternate to the PPP is the Information Productivity® (transaction efficiency) theory which proposes that investment in IT is not correlated to profitability, rather investment in IT is associated with the efficiency of the enterprise's transactions (Strassmann 1999b). This theory holds that transactions within a business are unique to that business and are therefore not measureable in the economic statistics. Some firms are better at employing IT to improve the efficiency of their transactions than others thus gaining a competitive advantage.

In relation to the main research question Q0, we ask:

Q7.0 Does the adoption of multimedia OHSE inductions support or refute the PPP?

Sub-questions:

Q7.1 Have multimedia OHSE inductions been cost effective? How has this been determined?

Q7.2 Has multimedia affected the efficiency of inductions?

Q7.3 Were ‘profits’ traded away before hitting the bottom line?

1.4.9 Post Adoption – Paradigm Shift

A paradigm shift in its simplest form occurs when the usual and accepted way of doing or thinking about something (the pattern) changes or there is a fundamental change in approach (*Compact Oxford English Dictionary of Current English, 3rd Ed. 2005*). This is the meaning taken and used in this research – one pattern used by enterprises for the delivery of OHSE inductions has been displaced by another.

Kuhn (1962/1970) developed a description of paradigm shift as it applies to the evolution of scientific thought. In this description, one pattern of thought or practice is replaced by another in a rapid change of world view. The new pattern completely replaces and makes archaic the old. For example, the idea that the world is flat is completely replaced by the idea that the world is round.

Disruptive technologies, also known as discontinuous innovations, have been identified by Anderson and Tushman (1990), Bower and Christensen (1995) and others as those innovations that bring revolution to the marketplace. They provide the basis for new paradigms and often provide exponential improvements in the value of products to clients. Products that provide a 5-10 times improvement in performance, 30-50% reduction in cost and/or performance have been identified as disruptive technologies (Kassicieh et al. 2000). The literature and the financial pages are rich with anecdotal evidence of new, small firms using innovation to attack existing markets - the classic dot com, IPO scenario (Walsh, Kirchhoff, and Newbert 2002). Bower and Christensen (1995) and Christensen (2007) described two categories of disruptive technologies – low cost, low end products that undercut an existing market, and high end, high cost technologies that fulfil a new market segment. Multimedia OHSE inductions are examined in the light of these classifications.

In either a paradigm shift or adoption of a disruptive technology, an element of revolutionary change is present. To make the change, a firm must be willing to scrap their old pattern of behavior in favour of the new. It is understandable that a certain amount of resistance is involved in such a change. Moore (1991) describes the process of ‘crossing the chasm’ as identifying significant value, profit and performance propositions adequate to support the jump.

In crossing the chasm, the adopting enterprises execute a ‘quantum leap’. A quantum leap is defined as ‘an abrupt change, sudden increase, or dramatic advance’ (*Merriam-Webster OnLine Dictionary*). The defining aspect of a quantum leap (and revolutionary change) is that the change from state #1 to state #2 does not entail the intervening states

1.1, 1.2 etc. – there is no halfway landing point on the passage over the chasm. The world can't be sort of flat or a little bit round.

In relation to the main research question Q0, we ask:

Q8.0 Has the change to multimedia OHSE inductions been viewed as revolutionary? If so, what factors proved powerful enough to cause the firm to 'take the leap'?

1.5 JUSTIFICATION FOR THE RESEARCH

1.5.1 Scope of the Multimedia Industry

The multimedia OHSE induction paradigm is part of the larger digital content arena. A report published by the Australian Federal Government concerning the digital content and multimedia industry (Strategic Industry Leaders Group 2004), established the following metrics for Australia: estimated worth A\$21 billion, represents 3.5% of the Australian GDP, employs 300,000 people, has higher economic multipliers than other economic sectors, includes applications in health, education and architecture, globally is the highest growth industry (7.3%) with growth twice the economy at large and estimated to grow by 50% by 2009. Any investigation of a growth area of this magnitude is by association important.

1.5.2 Justification of the Practice-Oriented Research

A theory, by definition, attempts to explain a phenomenon. Theory grows from phenomenon, innovation and practice. 'Researchers usually learn by studying the

innovations put in place by practitioners, rather than by providing the initial wisdom for these novel ideas.’ (Benbasat, Goldstein, and Mead 1987, p. 370). The ultimate recipient of the benefits of research is the practitioner. While it may not be common for practice-oriented data to be included in academic research, it can be justified where that research demonstrates a knowledge of the literature, is associated with and framed by theory and describes the processes, forces and limitations of the practice (Zmud 1997). The role of practice-oriented research is discussed further in Chapter 3.5.

This research identifies, explores, and describes innovation, implementation and practice not previously described in the literature and confirms and extends the base data available to educators, managers and practitioners.

A goal of this study is to provide guidance to other industries and disciplines concerning the development, implementation and use of multimedia for training and presentation purposes. Multimedia developers will benefit from this research by the identification of client determined usefulness, cost effectiveness and utility. This, in turn, may lead to the adoption of new authoring techniques, physical delivery methods, identification of new applications and markets.

The use and delivery of multimedia in OHSE applications has been little studied. This research describes and provides details of the uses to which multimedia is being put in the OHSE induction framework. This information will assist in the selection of appropriate training modes (single or group), delivery domains (PC, CD-ROM, DVD-

ROM, DVD-Video, intranet, internet WWW), and multimedia techniques (2D animation, 'blue screen', 3D modelling and camera fly-throughs).

This study adds to the literature detailed information that may assist in the creation, evaluation and effectiveness of industry OHSE and DOC programs of study. In the first instance, the study aims to describe the state of industry practice - what is the industry standard at this time? The study further aims to provide details of the benefits others have achieved in the areas of pragmatic efficiencies, economies of scale, convenience and flexibility of service.

1.5.3 Justification of the Theory-Oriented/Theory-Testing Research

The theoretical areas where this research may make a contribution are discussed in the following sections.

1.5.3.1 Theoretical Framework

This thesis endeavours to link a number of theoretical platforms into a framework of paradigm shift theories from inception to implications. This has not been previously attempted in the field of multimedia and may prove useful as a framework in future studies of other paradigm shifts.

1.5.3.2 Technology-Push / Market-Pull

This research adds to the literature a case study of the relationship between initial Technology-Push and Market-Pull for an emerging paradigm.

1.5.3.3 USP and Product Positioning

Research in this thesis is intended to identify, document and add to the literature an investigation of the role played by the USP and Product Positioning propositions in marketing.

1.5.3.4 The Technology Acceptance Model

The TAM/TAM2 theories are successful in explaining significant portions of the variations in intention to adopt technology, but their weakness lies in their lack of specificity in identifying the forces, factors and influences powering the actual usage. This research adds to the TAM/TAM2 literature by providing a more detailed and in depth examination of the usage and engendering imperatives in a specific framework.

1.5.3.5 Media Richness Theory

Reduction of equivocality in OHSE inductions is of high, even life saving importance. This research examines and extends MRT literature with an investigation into why multimedia was selected over to face-to-face media.

1.5.3.6 Duty of Care

This research adds to the literature a case study of the role of DOC in the adoption of OHSE multimedia inductions. This data may contribute to the behavioural modification strategies of legislative and safety bodies and enable OHSE professionals, researchers and industrial managers to leverage the information to create better outcomes in their own environments.

1.5.3.7 The Profitability-Productivity Paradox

IT, economics and business academics as well as the business community have an enormous interest in determining the size and nature of IT investment returns at any level. Venkatesh and Davis (2000, p. 186) link their TAM/TAM2 research to the PPP and comment that this ‘remains a high-priority research issue.’ While studies of the PPP tend to focus on the determination of value and pay off, profitability remains an issue. This has been identified as an area ripe for future research - ‘Firm-level studies have so far failed to show a clear link from IT investment to profitability.’ (Dedrick, Gurbaxani, and Kraemer 2003, p. 12).

PPP studies have also recommended future research in the micro area and said that most of the firm-level research involved data from large firms as it was more difficult to get good financial data on smaller firms (Dedrick, Gurbaxani, and Kraemer 2003; Melville, Kraemer, and Gurbaxani 2004). Wu and Chen (2006, p. 373) suggest that future research should provide insight into the decisions of management to invest in IT applications and that ‘...case studies with longitudinal experience will be the other way to more clearly examine the performances.’ Melville, Kraemer and Gurbaxani (2004)

recommended the examination of similar firms in a single industry (across countries if possible).

It is a specific target of this research to determine if multimedia OHSE inductions can refute the PPP by demonstrating improved productivity and profitability. It is a further specific target of this research to determine whether if gains in profitability and productivity from the use of multimedia OHSE inductions exist, do they reach the bottom line? If not, where do they go? Few, if any, studies, and certainly no multimedia studies, have described how profitability, when it has been achieved, has been traded away before hitting the bottom line. A major goal of this research is to describe this possible dissipation.

1.5.3.8 Paradigm Shift

This research explores the paradigm shift to multimedia OHSE inductions and adds to the literature a case study of the factors, forces and influences necessary to cause the adopters to ‘leap the chasm’ from traditional OHSE inductions to multimedia. It further explores and compares this leap to the theories of revolutionary and disruptive technology.

1.5.3.9 Education

The superiority of multimedia over traditional classroom training has been widely studied in the literature (Perry 2003b, 2003a). This thesis adds to and extends that body of knowledge by examining in detail an application of multimedia methodology and the

perceived benefits. Entertainment, games, film animation and web site design are widely known applications of multimedia. The emergence of a new multimedia paradigm is therefore of particular interest to educators in setting curricula.

1.5.3.10 OHSE and Beyond

The factors, forces and influences investigated in this thesis will form a knowledge base for those intending to address or further investigate factors behind multimedia OHSE adoption and practice. While targeted specifically towards OHSE, this research may provide useful insights that have applicability in other multimedia and training areas.

1.6 METHODOLOGY

1.6.1 The Case Study Methodology

As per Benbasat, Goldstein and Mead (1987), case study methodology is indicated under the following circumstances:

- Little is known about the subject
- The subject is idiographic
- The data is captured from the practitioners in its natural environment
- The aim is description of practice and adoption
- The paradigm is an emerging field and the focus is on contemporary events:

Yin (2003b) cites the investigation of ‘decisions’ as the major focus of case studies. Yin further advises that when the question is of the ‘what’ variety, that both the exploratory strategy (the goal being to test propositions) and the descriptive strategy (the goal being to determine ‘how much’ or ‘how many’) are applicable. The major research question in this research meets all these requirements:

Q0: What factors, forces and influences are driving the technological paradigm shift from traditional OHSE inductions to multimedia?

As the research questions and framework meet all the designated criteria for the use of case study methodology, case study methodology is therefore appropriate.

1.6.2 Units of Study

This research has as its target of study the clients of an Australian company that creates and markets multimedia OHSE inductions. ‘The Multimedia Company’, an alias used in this research, and its clients which are used as the case study units, are more fully described in Chapter 3.7.

Data collected from The Multimedia Company during previous MSc research identified the industries and firms adopting the technology, the types of inductions, delivery domains and presentation methods (Wright 2005). This data provided the basis for framing the context, choice of research methodology, and the choice of the units of study.

As described in Chapter 3.7, the case study unit matrix was formed by clients of comparable size in each of a number of sectors and industries to provide both exploratory and confirmatory cases. Where additional clients in a particular industry were readily available, they were included.

In investigating the innovation and marketing aspects of the study, sales records, multimedia presentations and web site history were consulted. Marketing and design staff were consulted where necessary for clarifications.

1.6.3 Practice-Oriented Design

A portion of this thesis contains practice-oriented research. The implementation of multimedia OHSE inductions was investigated and described in order to determine a model of practice and to be able to compare that practice against previous practice. Each multimedia OSE induction was evaluated as to features, content and multimedia techniques. This descriptive data provided the basis for the theory-oriented/theory-testing work which followed.

1.6.4 Theory-Oriented/Theory-Testing Design

Armed with the induction evaluation data obtained in the practice-oriented research, a list of sample questions was developed which allowed further description of the multimedia induction process and addressed the theory-oriented aspects of the research. A first person, elite interview using open ended questions was conducted with a single key person from each client chosen as a case study unit (please see Chapter 3.7.3 Elite

Access Opportunity). A thematic analysis was conducted for each interview and the research written up.

1.7 OUTLINE OF THE THESIS

This thesis is organised in a classic ‘5 chapter’ format as recommended by Perry (2006) with an additional chapter to allow a division between the practice-oriented and theory oriented data analysis. Chapter 1 contains the statement of the research problem and questions, and brief descriptions of the background to the research, justification for the research, methodology, delimitations of scope and key assumptions. Chapter 2 contains a detailed discussion of the literature, parent disciplines and theoretical platforms addressed in this research. Chapter 3 contains a detailed description of the case study methodology and interview strategy employed for the research. Chapter 4 contains a description of the multimedia OHSE induction model, a comparison of the multimedia model to the traditional model, analysis of the features and contents of the inductions and the multimedia techniques employed. Chapter 5 contains a thematic analysis of the anticipated theoretical outcomes as compared to those obtained from the case study unit interviews. Chapter 6 contains a summary of the Practice-Oriented and Theory-Oriented findings, their impact on practice and theory in the private and public sectors, identification of the limitations of the research and suggestions for future research.

1.8 DELIMITATIONS OF SCOPE AND KEY ASSUMPTIONS

1.8.1 The Author's Relationship to the Research

In Chapter 3.2, several issues relating to the author's experience, relationship with the case study units and case study unit selection are discussed in detail. It is acknowledged that these issues will have an effect on the research and it is asserted that the affect has been positive.

1.8.2 Non-adopters and Other Adopters

No attempt has been made to discover or include non-adopters in this research. While the ultimate goal of Davis et al. (1989) was to identify the reasons for the rejection of technology and thereby increase the potential for its uptake, the overwhelming majority of research literature is focused on adoption rather than rejection. The focus of this research is on implementation and practice, not on intention or non-intention as might be the case with a survey-based study of adoption.

There being limited time, resources and capacity and considering that there were adequate units available for the study (as discussed and justified in Chapter 3.7), no attempt was made to include adopters outside the resource pool provided by The Multimedia Company.

1.8.3 Chronological Adopters

Rogers (1962, 5th Ed. 2003) and others identified categories of adopters based on their enthusiasm for adoption. These were generally classified as innovators, early adopters, early majority, late majority, and laggards. The adopters were found to be influenced by different factors depending on the chronology of adoption - for example, demonstration of superiority becomes a more important factor as time progresses.

Due to the youth of multimedia OHSE inductions and for the purposes of this study, all the adopters are considered to be innovators and/or early adopters. No research into adoption based on chronology is included in this thesis.

1.8.4 Selection of Theories and Alternate Plausible Theories

It is sometimes stated that the case study researcher may have less *a priori* knowledge of the theories, variables of interest and their metrics. Benbasat et al. (1987) emphasises that this is often only a matter of degree. In many instances, the researcher has a prior notion of the important variables and case study units for which more information is sought. Perry (1998) argues that prior theory for the case study arises from experience, existing literature and pilot studies. Prior theory provides a focus for the case study.

There are literally thousands of theories that touch on the main areas of the research – innovation, marketing, adoption and post adoption impacts. The seven theoretical platforms chosen for investigation in this study - Technology-Push/Market-Pull, USP/Product Positioning, TAM/TAM2, MRT, DOC, PPP and Disruptive Technology – are

all mainstream if not predominant theories in their field. If they are not the ‘best’ theories for the purpose, then they are at least close enough to be adequate theories. There may also be any number of plausible, alternative theories. Rival plausible alternatives were searched for and evaluated during and post the investigations and none were identified as important within the constraints of the study.

1.8.5 Best Practice and Business Process Management

Descriptive case studies and in particular those containing practice-oriented studies are often classified as ‘best practice’. Best practice methodology involves systematically identifying those who have produced superior results as demonstrated by a quantitative standard(s) (*Benchmarking - what is best practice?*). Although this research identifies a new, ‘better practice’ paradigm, it is not a best practice study.

Business Process Management (BPM) is the new kid on the management studies block. BPM has evolved from Total Quality Management (TQM) and Business Process Re-engineering (BPR). BPM is a discipline that employs IT tools to describe, model and measure business processes with a view to improvement (Hill et al. 2006). While this research describes models and to some extent measures a business process, it is not a BPM study (although with some effort it might provide the basis for a BPM intervention).

1.8.6 Pedagogical Issues

It is not the intent or within the scope of this study to address or investigate the pedagogical issues relating to multimedia training. If better training outcomes are presented by The Multimedia Company as a marketing proposition or identified by a client as a factor in adoption, it will be recorded. However, there will be no attempt within this study to test the proposition that multimedia provides a better training outcome than other methods.

1.9 COMMERCIALLY SENSITIVE DATA

As part of the permission given by the Multimedia Company to access their clients and data, it was agreed that commercially sensitive cost and pricing data would not be reported in detail. While this information would have been of interest to prospective adopters and others, it was unfortunately but understandably not available. However, in Chapter 5.7.1, the case study participants' responses to questions concerning cost effectiveness are listed in detail.

1.10 CONCLUSION

This chapter presented the background of the research, stated the research questions, justified the research, introduced the methodology, outlined the format of the thesis and established the delimitations of the scope and key assumptions. In Chapter 2, we will review and discuss in detail the literature and theory as they relate to the research questions.

Chapter 2 LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents and reviews the literature, theoretical background and issues associated with the theory-oriented/theory-testing research questions contained in Chapter 1. In particular, the goal of this chapter is to identify literature concerning the wider bodies of knowledge relevant to the research, identify and place the research questions in each body of knowledge, critically appraise the literature as it applies to this research, and identify relevant research areas not previously addressed. In particular, four themes in the paradigm theoretical framework as shown in Figure 1-2 (innovation, marketing, adoption, post-adoption) are addressed. Within these themes, seven specific theoretical platforms as shown in Figure 1-3 (Technology-Push/Market-Pull, USP/Product Positioning, TAM2, MRT, DOC, PPP and Paradigm Shift) are investigated. The following sections address the existing literature and the position of this research within that body of literature for each of these nominated theoretical platforms.

2.2 MULTIMEDIA AND E-LEARNING

The word e-learning (literally electronic learning) was coined by Jay Cross in 1999 as an umbrella term that incorporated all uses of electronics in education (Hart 2009; Cross 2011). It has since universally come to mean IT supported learning (*Merriam-Webster OnLine Dictionary*). As this research investigates the adoption of multimedia OHSE inductions as a form of e-learning, a brief overview of the multimedia in relation to the e-learning literature is appropriate.

For the purposes of this discussion, the e-learning literature may be roughly divided into three categories – i) delivery technology, ii) pedagogical outcomes, and iii) authoring and implementation issues.

2.2.1 Multimedia Delivery Technology

An essential attribute of e-learning is content delivery employing IT technology. E-learning content delivery has grown with the development of IT technology. Simple, standalone text retrieval systems, colour VDUs, digital graphics, audio, animated graphics, small sized video, full screen video, the internet, the WWW, webinars, hyper-text, search engines, collaborative document creation, podcasts and streaming video have all been technological steps along the way culminating in today's multimedia as a commonly method of delivering e-learning .

What is multimedia? Media is the plural form of the word medium, where medium is used to mean a form of mass communication. At its simplest level, multimedia literally means a combination of mass communication forms. But which forms? The usual answer is *all forms*. At the 1991 Comdex convention (generally regarded as the major computer exhibition in the USA), a panel of industry leaders discussed the new field of multimedia. Bill Gates famously defined multimedia as 'software that includes audio, video and text' (Schlossberg 1992). Since that time, the term 'audio' has been expanded to include spoken dialogue, sound effects and music, and the term 'video' has been expanded to include movie footage, animation (cartoons, life-like characters and graphics) and panning pictures (from nature, graphics or 2D/3D models). Another panel member, David Archambault, of Commodore Business Machines, expanded this

definition to include ‘one piece of equipment that administers all those functions through one control mechanism’. Carolyn Kuhn, president of Software Mart Inc., added the requirement for ‘a compelling use’ to propel these ‘dazzling applications’ in to mainstream use. E-learning has certainly been one of those dazzling applications.

One essential piece of the multimedia mix that was not addressed in the 1991 panel discussion was the emphasis now placed on the role of interactivity. Most modern definitions of multimedia include a reference to the importance of the interactive aspects of the medium (Gonzalez 2000). Gonzalez also emphasises that the interactivity can’t be isolated from the medium because it is the medium. Piccoli, Ahmad and Ives (2001) devolve interactivity one step further to interaction and control (control referring to the extent to which the learner can direct the system).

The ‘one piece of equipment’ identified in 1991 may now be a Personal Computer (PC), networked PC workstation, internet connected PC workstation, a Digital Versatile Disk (DVD) player or a dedicated games playing console (for example Sony Play Station). Upon first inspection, a DVD player may not appear to pass the multimedia or interactivity test. However, the DVD player has the ability to include interaction via chapter navigation, arrow button menu selection, keypad input (limited as it might be) and instant re-play.

Multimedia is a combination of content (the message) delivered via a communication channel (the medium). The message and the medium are sometimes referred to in a more formal manner as the ‘information space’ and the ‘operational environment’

(Schlossberg 1992). The use of each of these ‘spaces’ in the multimedia OHSE participant inductions is tabulated in Chapter 4.

2.2.2 Pedagogical Outcomes

One of the problems of reviewing the e-learning literature is the proliferation of terms and acronyms. Combinations of the terms electronic, computer, web, etc. with aided, based, enhanced, etc. and learning, instruction, education etc. can produce thousands of search terms and acronyms that will return tens of thousands of publications. Nearly all e-learning publications are devoted to pedagogical issues. Pedagogical issues include learning outcomes, student learning experience, motivation, attitudes and satisfaction.

As highlighted in Chapter 1.8.6, pedagogical theories and outcomes are specifically excluded from this research. However, to touch briefly on the issue of the efficacy of e-learning, Russell (1999) compiled 350 comparative studies of e-learning to instructor-classroom delivered training and found no significant difference in learning performance. Others (Clark 1994; Collins 1995; Gilbert 2007) have concluded that the outcomes are a function of the learning implementation not the technological implementation.

2.2.3 Authoring and Implementation

There are many publications concerning the authoring and design of e-learning systems - for example Garrison and Anderson (2003). Knowlton and Simms (2010) provide an example of establishing objectives in the design of a multimedia/e-learning system.

Zhang, Zhou and Nunamaker (2004) neatly summarised the implementation advantages of multimedia e-learning as time and location efficient, cost-effective for learners, potentially available globally, access not limited by infrastructure and archival capabilities. Support for increased implementation efficiency was first provided by Fletcher (1990) and was later confirmed by a number of studies (Adams 1992; Cantwell 1993; Hofstetter 1994). Both Hall (1995) and Hemphill (1997) found reductions in time as compared to instructor based training.

Literature on industry specific implementations of multimedia (some of which relate to e-learning applications) include the manufacturing industry (Gunasekaran and Love 1999; Leung, Leung, and Hill 1995), and medicine where Fox (2009) reviewed 25 studies that examined the impact and patient outcome of interactive computer systems and Lapointe, Mignerat and Vedel (2011) tested the PPP of a patient system from a stakeholders perspective.

Systems for evaluating e-learning systems from the implementation as well as the student learner side have been investigated by a number of researchers. In secondary and tertiary education, de Villiers (2004), de Villiers and Ssemugabi (2007) compared the assessment of e-learning systems by heuristic expert evaluation versus end user surveys. They found that heuristic evaluation systems based on expert guidelines were more successful in identifying problems than user interviews by themselves. A conflict between the intent of the instructors to have the material studied in a linear manner versus students' desire to jump around in the material was identified. Ozkan and Koseler (2009) employed a multi-dimension model consisting of content, system and service quality, learner perspective and instructor attitude to an e-learning computer

literacy course and found instructor quality to be the most significant factor closely followed by information content quality.

Linkels et al. (2009) surveyed 821 teachers in the Luxembourg school system to investigate implementation and instructor attitudes and motivation. IT was found to be predominantly employed to support paper based teaching rather than as tools for student learning. A number of teachers (25%) were concerned that the increased lesson preparation time for e-learning modules was in most cases not rewarded. E-learning was concentrated in particular subjects - the teaching of languages accounted for 30% of the e-learning modules with the next largest discipline being mathematics at 10%.

2.2.4 Critique and Relevance

The overwhelming majority of e-learning publications are concerned with pedagogical issues. Multimedia is only one form of e-learning delivery. This study is focused on ‘supply side’ aspects of the adoption of a multimedia e-learning system, not the learning outcomes. Therefore, in this research the term multimedia has been purposely chosen over e-learning to avoid any confusion.

While the other publications in the multimedia e-learning sector do not address the practice-based or theoretical investigations provided in this research, some support is given for improved efficiency using multimedia e-learning.

2.3 INNOVATION: TECHNOLOGY-PUSH/MARKET-PULL

2.3.1 Technology-Push/Market Pull Literature

In this research, the ‘technology’ in Technology-Push/Market-Pull is multimedia.

Technology-Push is defined as ‘technology development that is driven by ideas or capabilities created by the development organization in the absence of any specific need that consumers may have. In Technology-Push situations, innovations are created and then appropriate applications or user populations are sought that fit the innovation.’

(*Usability First Glossary* 2008). An example of Technology-Push is the optical laser.

The laser was a technological marvel initially presented to the market as a scientific curiosity with no apparent application.

Market-Pull (also known as Demand-Pull) is defined as ‘technology development that is driven by user needs and requirements rather than by ideas or capabilities created by the development organization’ (*Usability First Glossary* 2008). Market-Pull occurs when the market asks for a product for which either no technology exists or asks that existing technology be modified to suit a market requirement. Flat screen television is an example of the first scenario – the public has always wanted this technology even though none existed. The laser is an example of the second - having examined the technology, the market suggested that the device could be used as a weapon, to provide extremely accurate distance measurements for surveying, or to read the surface of digital storage devices. The CD/DVD was born, laser ranging devices appeared, etc.

Moore (1991), Bower and Christensen (1995) and Walsh et al (2002) examine how technologies may emerge from both the Technology-Push and Market-Pull paths and

determine that a pure Technology-Push strategy is usually disruptive, is adopted where the innovation firm has no established client base and where (new) customer resistance is seen as the major barrier to adoption. Once adopted, the new users set off the market-pull phase of development as they gain experience with the new technology and ask for changes and improvements.

The discussion in the literature was originally focused on the source of innovation and the relative importance of Market-Pull (Schmookler 1966) versus Technology-Push (Rosenberg 1974). Later, the generally accepted picture of this dichotomy (Rehfeld, Rennings, and Ziegler 2007) was that technological innovation was more relevant in the initial stages of a product life-cycle with market factors becoming more important as the product matured (Pavitt 1984). Carayannis and Roy (2000) added the dynamics of Technology-Pull and Market-Push to the innovation landscape and supported the idea that the balance between these four forces varies over time. Consulting firm Gartner has developed the 'hype cycle' to illustrate the various stages of the life cycle of a new technology from the 'initial technology trigger', to the 'peak of inflated expectations', into the 'trough of disillusionment', then up the 'slope of enlightenment', to the 'plateau of productivity' (Fenn 2007). While not directly distinguishing between the Technology-Push and Market-Pull aspects, the concept does show a double peak of 'visibility' more or less corresponding to the two phases. Schmoch (2007) further examines this double-peak of technology adoption via the mechanism of counting patent applications. He finds the process of innovation to be non-linear and lengthy.

2.3.2 Critique and Relevance

The existing literature is mainly concerned with determining the source of innovation - the general consensus being that it is a combination of Technology-Push and Market-Pull. There are few if any case studies in the literature illustrating how this might occur. In this research, we are concerned with the process of technology evolution from science to consumer rather than attempting to resolve the 'chicken and egg' proposition. This research examines a microcosm of technology in the form of a multimedia application and examines the technological product that was originally pushed to the market, what part of that product the market accepted, what changes the market requested, and in what manner the product was modified to meet those requirements. This research further examines the multimedia techniques currently being pushed (incorporated) in the adopted OHSE inductions.

In respect of the main research questionQ0, we ask:

Q2.0: In what ways and to what extent have Technology-Push and Market-Pull forces been factors in the multimedia OHSE induction paradigm shift?

2.4 MARKETING

2.4.1 Introduction

Marketing may be defined as 'the promotion and selling of products or services', and advertising may be defined as 'presenting or describing a product, service or event in a public medium so as to promote sales' (*Compact Oxford English Dictionary of Current*

English, 3rd Ed. 2005). Advertising is therefore the presentation in a public medium (such as television or newspaper) of a promotional strategy (as described below). We acknowledge that while there are many differences and distinctions within their respective fields, for the purposes of this study, the terms advertising and marketing will be used synonymously to mean marketing strategy.

The entries in Table 2-1 summarise Frazer's (1983) survey, description and classification of the main marketing strategies - Generic, Pre-emptive, Unique Selling Proposition (USP), Image, Product Positioning, Resonance and Affective. While somewhat dated, his classification has not since been bettered in the literature.

The strategies most suitable for the introduction of an innovative product are USP and Product Positioning. This choice of strategies is strongly supported by Foxall (1984) who states that innovation depends vitally upon presenting prospective consumers with a distinct advantage in terms of price or performance (which he says may often be expressed simply as a USP) and a noticeable difference from competitor's products – that is, a Product Positioning (Foxall 1984, p. 185). The use of these two strategies in the marketing of multimedia OHSE inductions is investigated in this research.

2.4.2 Unique Selling Proposition

In his watershed book, *Reality in Advertising* (1961), Rosser Reeves drew on his lifetime experience in advertising to describe the Unique Selling Proposition (USP). USP describes a marketing strategy where a proposition(s) is made to a prospective adopter concerning the features, benefits and advantages that are both unique and

Table 2-1 Marketing Strategies (after Frazer (1983, p. 40))

Strategy	Description
Generic	A product is promoted with no distinguishing features. Best suited where a single company has a dominant market position – ‘Intel Inside’.
Pre-emptive	A product is promoted with a generic feature that forces competitors into a ‘me too’ position. Best Suited to a highly competitive market with little product differentiation. For example ‘Ice Beer’ promoted as being brewed in temperature controlled vats. All beers are brewed this way. To counter this strategy, competitors must say ‘me too’.
USP	First described by Rosser Reeves (1961), this strategy identifies the meaningful, distinctive characteristics or benefits of a product e.g. ‘world’s thinnest notebook computer’. Best suited to high technology products where unique features are easily identifiable.
Image	This strategy attempts to link a product with an image – usually of a celebrity or location. Prestige claims do not directly attack competitors. Best suited to crowded markets where individual claims cannot easily be substantiated. Competitive ‘My celebrity promoter is more famous than your celebrity’ may be effective.
Product Positioning	Product Positioning is the mental equivalent of the physical USP – the aim is to position the product or service in the consumers mind relative to other, competing products – ‘xxx is greener than yyy’. This strategy is particularly well suited to the introduction of new products that challenge current market leaders.
Resonance	Resonance attempts to evoke stored experiences to promote re-use of a product – ‘It’s xxxx time!’. Best suited to socially visible consumer goods. Few direct competitive strategies.
Affective	This strategy attempts to involve the consumer in an emotional connection with the product – ‘Share the fantasy’. This strategy is useful for the promotion of products that are essentially emotive in nature such as fashion, sports cars and alcoholic beverages.

significantly better than those offered by competing products - and that these differences are strong enough to compel adoption. Reeves (1961, p. 64) demonstrates the requirement for both significant and compelling differences in the following paraphrased example:

‘There is a better mousetrap’ (no significant differences identified, not compelling)

‘Throw away all other mousetraps. As of today, every other trap is out of date’ (compelling but no significant differences)

‘Amazing new mousetrap catches 6 times more mice, uses far less cheese, makes other traps obsolete’ (significant differences and compelling)

Where a product does not have a USP, Reeves recommends the product be changed to incorporate one. The USP strategy does not include direct comparisons or disparagement of a competing product as is often used in Product Positioning. The marketing catch phrase ‘The new Whiz-o motor car runs on only 1 cylinder’ employs a USP while ‘Whiz-o costs 10% less than Zipp-o’ does not.

2.4.3 Product Positioning

Product Positioning is the second marketing strategy to be investigated in this research. Hotelling (1929) introduced the idea of a product ‘space’. In Hotelling’s original example, the product space was single dimensional - location. Products produced closer to the consumer would attract preference. Many authors followed and added additional dimensions to the product space and developed associated mathematical techniques. Kaul and Rao (1995) provide an exhaustive summary of these developments and summarise the field as follows: ‘The extant consumer decision theory assumes that consumers are rational utility maximizers and choose the product (from a set of available alternatives) that gives them maximum utility’ (Kaul and Rao 1995, p. 320).

The utility gained is affected by the consumer's perception of the product, its attributes, the alternatives and range of choices.

In their book *Positioning: the Battle for Your Mind* (1986), Ries and Trout (advertising executives) popularised the advertising concept of Product Positioning which differs in emphasis from the mathematical construct of the previous researchers. According to the authors, Product Positioning posits that the mind is constantly being assaulted with confusing information that invokes negative emotional responses – especially fear. A completely unknown product or service isn't 'like' anything else and is therefore likely to invoke negative feelings. In order to allay these emotions, products need to position themselves against other known products, trusted authorities, celebrities or heritage. Marketers go to extreme lengths to accomplish this goal. The motion picture industry provides an example of aligning new movies with previous successes – 'King Kong Attacks Hollywood'. The first generation of cellular phones elicited many misgivings about health and privacy issues. The next generation were smaller, prettier, cheaper, digital rather than analogue and were more easily marketed because there was something with which to compare them ('The brick you used to use').

2.4.4 Critique and Relevance

There is an enormous body of literature concerning marketing science and consumer behavior – much of it conflicting. For example, Armstrong (1991) compared 1,736 predictions of consumer behavior by 12 experts, 16 academics and 43 high school students. The experts and academics were no more accurate than the students. Anderson (1994) reviews the literature and history of efforts to establish marketing science as a

valid science and concludes that ‘Today there is little agreement among researchers, creative staff and clients about what makes consumers tick’ (Anderson 1994, p. 3).

While Reeves (1961) claims many successes for the USP, there is an almost complete lack of academic research into the USP proposition. It appears that the USP has been accepted into the lexicon as axiomatic. A Proquest search executed 29th September, 2010 using the terms ‘unique selling proposition’ and ‘research’ with no date restrictions returned only 37 publications – none concerned any actual testing of the USP theory. As another example, a search of the Canadian Theses database conducted 29th September, 2010 with no date restrictions identified five theses that mention USP. None of the five questioned the validity of the USP concept, provided a reference for its source, or discussed its meaning or use (Gargouri 1997; Harley 1998; Cairns 1999; Young 2000; Baumann 2000; *Theses Canada*). Examining other sources, in a search conducted 29th September, 2010 with no date restrictions, neither *The Journal of Advertising Research* nor *The International Journal of Research in Marketing* contained any articles whose title or abstract indicates that it tested or questioned the validity of the USP.

In the case of Product Positioning, Krishnan and Ulrich (2001) reviewed hundreds of papers on product development decisions including product positioning, without identifying any relationship between rate of production ramp up (market take-up) and product decision making. Rhim and Cooper (2005) is a typical paper that analyses the introduction of a new product (washing detergent) into a multi-dimensional and multi-segmented market using a mathematically rigorous model. The study makes predictions as to the likely successful strategies that may be employed. The quality of the

quantitative research is obvious – but there are no implementation case studies to support it. Without case studies, there can be little academic support for the Product Position proposition.

On what basis, therefore, are the USP and Product Positioning market strategies included in this research? The first source of support for these strategies comes from the marketers themselves. The books of Reeves and Ries and Trout abound with marketing strategy success stories. Nothing in the literature suggests these examples are false. There are myriad figures in these books touting the efficacy of both strategies. While impressive, these figures, as has been said previously, lack academic verification. A possible explanation may lie in the fact that much of the research in advertising is privately funded. Perhaps no comparable body of research exists in the academic world because of the presumed value and confidential nature of the results. The evidence may exist, but it is closeted within the advertising agencies. A second source of support for the validity of these marketing strategies is their continued use by business. Businesses are pragmatic - if these marketing strategies were not cost effective, they would not continue to use them. The third support for these marketing strategies comes from independent market research companies. For example, Research Systems Corp. can present evidence that compared to a weak USP, a marketing campaign with a strong USP is 75% more likely to succeed (Hume 1993).

In the future research section of their review of Product Positioning literature, Kaul and Rao (1995) make the observation that there is almost no literature on the optimal Product Positioning of revolutionary products. Kaul and Rao's observation still remains

true in 2010. This research examines adopters of a revolutionary product and therefore helps reduce the paucity of case studies for both marketing strategies.

In respect of the USP and Product Positioning strategies, we therefore ask:

Q3.0: In what ways and to what extent have USPs and Product Positioning arguments been influential in the adoption of multimedia OHSE inductions?

2.5 ADOPTION: TECHNOLOGY ACCEPTANCE MODELS

2.5.1 Introduction

The literature is rich with theories concerning technological adoption. The goal of these theories is to understand the diffusion of technology, the reasons for adoption, the reasons for rejection and ultimately to provide insight into how to increase user acceptance (Davis, Bagozzi, and Warshaw 1989). Two themes characterise these theories – adoption and perception.

The first theme proposes that the availability of a technology (Technology-Push) is not enough – it must also be accepted and used (adopted). Examples of technologies that were available but not accepted include IBM's OS2 operating system, the Video Disk and the Iridium satellite telephone. The aphorism of 'use it or lose it' seems apropos. The success of a technology may be judged to be equivalent to its use.

The second theme of these theories is the concept that perceptions influence adoption. These theories attempt to resolve the dichotomy between technological availability and

adoption by operationalising perception of a variety of factors associated with adoption. Knowledge of these perceptions may then be proactively used by management or others to influence adoption (Agarwal and Prasad 1997).

The main theories that culminate in the TAM (Davis 1989) as described in Chapter 2.4.4 and their relationship to the research questions are examined. The efficacy of the TAM versus other models of technology adoption is addressed in Chapter 2.4.8.

2.5.2 The Diffusion of Innovations Theory

One of the earliest conceptual frameworks for the spread of new ideas, the Diffusion of Innovations Theory (DIT), was posed by Rogers (1962, 5th Ed. 2003). In this theory, diffusion of technology is described as a social process. Rogers determined that information exchange about innovation occurs between individuals and groups and involves interpersonal relationships. The process is no different to the diffusion of other information within and between communities or enterprises. The same management skills necessary to manage and successfully employ other forms of information are applicable to the adoption of technology (Rogers 1962, 5th Ed. 2003).

Rogers examined thousands of examples of innovation and identified five categories of adopters based on their enthusiasm for adoption – innovators, early adopters, early majority, late majority, and laggards. He highlighted the differing emphasis placed on influences by the chronology of adoption - for example demonstration of superiority becomes a more important factor as time progresses.

Rogers further identifies three categories of adoption decisions - independent, collective, and authoritarian – each made in turn by individuals, consensus within a group and at a high management or technical level. In the first instance, an individual may choose to adopt an innovation without reference to their peers or higher authorities (e.g. at home the individual uses the XYZ computer operating system that only 40 other people in the world use). Adoption by consensus involves elements of peer approval, herd mentality and group decision making where the individual's choice may be limited (e.g. if you don't have the WXY telephone that all your friends have, you aren't 'cool' and can't exchange images with them). Adoption by mandate (management or legislative) leaves no individual choice (e.g. at work the ABC computer operating system will be used). These may combine when two or more categories are active in a decision.

The five attributes which Rogers proposed influence innovation are Relative Advantage (the degree to which the new technology's benefits are perceived to exceed its precursor's), Compatibility (the degree to which the new technology is perceived to meet the requirements of its precursor), Complexity (the degree to which a new technology is perceived to be difficult to implement or maintain), Observability (the degree to which the benefits of a new technology can be demonstrated) and Trialability (the degree to which a new technology can be tested prior to adoption).

Moore and Benbasat (1991) re-cast Rogers' complexity attribute to Ease of Use and expanded Rogers' five attributes to include Image (social approval by others) and Voluntariness (the degree to which use of the innovation is seen to be mandated). They

named the seven attributes the Perceived Characteristics of Innovating (PCI). They further divided Observability into the Result Demonstrability and Visibility constructs.

Rogers (1962, 5th Ed. 2003) claimed that the original constructs in the DIT theory accounted for 49-87% of the variance in adoption. Subsequent studies of the DIT and PCI theories in diverse fields have found that at least some of these constructs had a strong influence on adoption (Tornatsky and Klein 1982; Agarwal and Prasad 1997; Slyke, Lou, and Day 2002; Chen, Gillenson, and Sherrell 2004; Hsu, Lu, and Hsu 2007; Treanor 2002).

Can the constructs influencing individual adoption identified by Rogers be extended to organisations as adopters? Rogers said yes. He stated that an innovation spreads among the companies in an industry in a diffusion process that is similar to the way that an innovation diffuses among individuals. This is the situation being investigated in this research. Rogers further described the characteristics of innovative organisations as equivalent to those of innovative individuals. Is this transference of units of analysis widely practiced? Rogers identified hundreds of studies that have been done in this manner.

Studies have been completed using DIT in the field of IT (Agarwal and Prasad 1997; Brancheau and Wetherby 1990; Hoffer and Alexander 1992; Karahanna, Straub, and Chervaney 1999; Moore and Benbasat 1991; Tornatsky and Klein 1982). Figure 2-1 illustrates the elements of the expanded DIT/PCI theory.

2.5.3 The Theory of Reasoned Action and Theory of Planned Behavior

The Theory of Reasoned Action (TRA) asserts that behavior (more specifically, the decision to adopt – in this instance a technology) arises from intention, which in turn arises from two perceptions - beliefs regarding the consequences of the behavior (good versus bad outcomes) and beliefs regarding the social image of executing that behavior (Ajzen and Fishbein 1980). The former is termed ‘behavioural beliefs’, the latter ‘normative beliefs’.

The TRA is less specific than the DIT in its identification of the perceptions affecting behavior. Rather than starting with a predefined set of perceptions, Ajzen and Fishbein (1980) suggest eliciting five to nine salient perceptions (beliefs) in order to determine the specific behavioural beliefs applicable to the specific behavior. Historically, the TRA accounts for typically 40-50% of the variability in Behavioral Intention (Godin and Kok 1996; Sheppard, Hartwick, and Warshaw 1988; Ajzen 1991). Figure 2-2 illustrates the relationship of the various elements of the TRA.

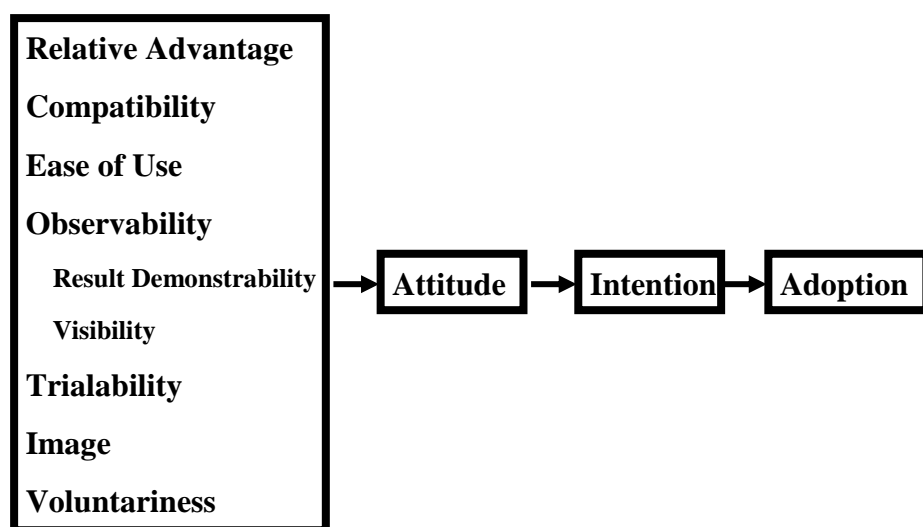


Figure 2-1 Elements in the Perceived Characteristics of Innovating Theory

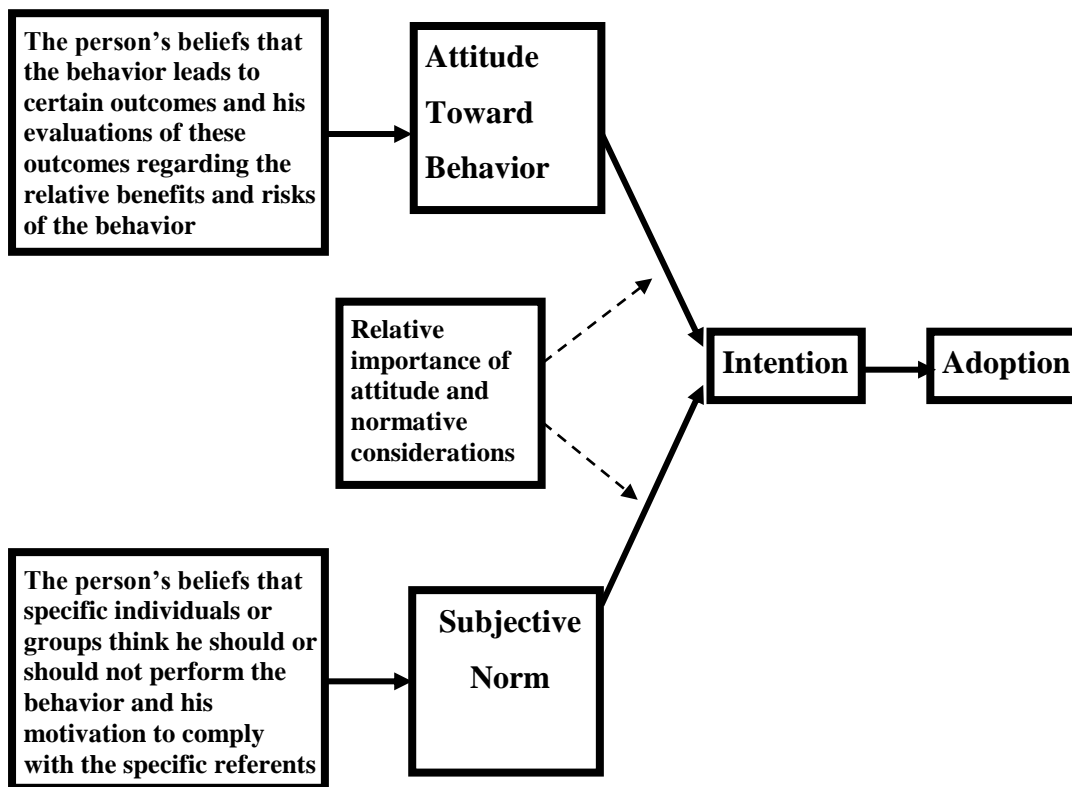


Figure 2-2 Elements in the Theory of Reasoned Action (Ajzen and Fishbein 1980, p5)

The TRA introduces the ‘Subjective Norm’ construct. Subjective Norm is defined as a combination of perceived expectations from relevant individuals or groups along with intentions to comply with these expectations. ‘In other words, the person's perception that most people who are important to him or her think he should or should not perform the behavior in question’ (Ajzen and Fishbein 1975, p 302).

The TRA was extended by Ajzen (1985) and tested by Ajzen and Madden (1986) to take into account compulsory factors. The initial title of the theory - ‘Perceived Behavioral Control’ - meaning the individual’s perception of their control over behavior, was later changed to the Theory of Planned Behavior (TPB) (Ajzen 1991).

Figure 2-3 illustrates the elements included in the TPB. A meta-analysis of 154 studies found that Perceived Behavioral Control added only 6% to the prediction of behavior over the TRA (Armitage and Conner 2001).

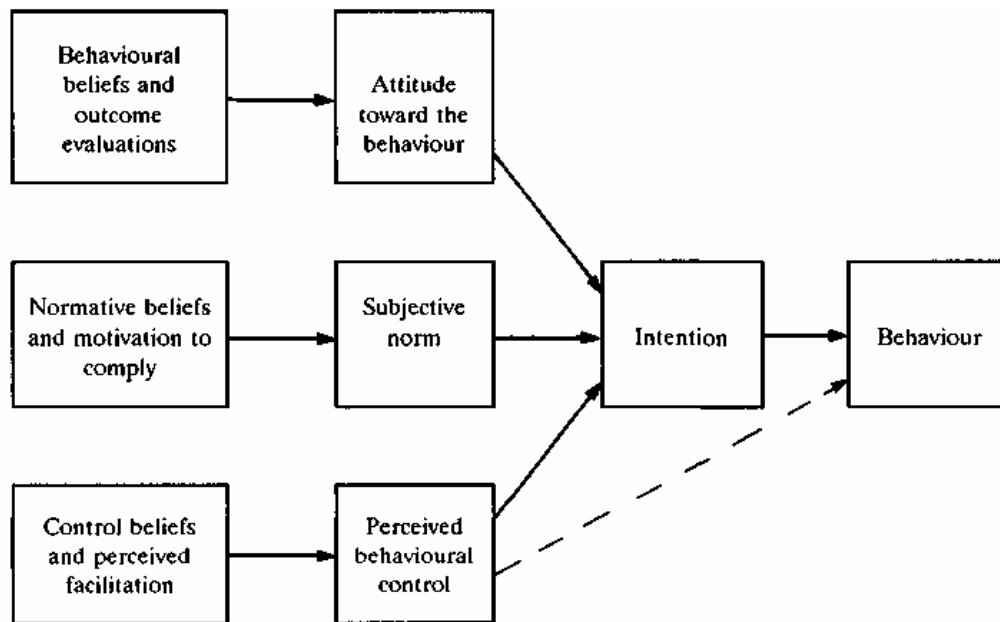


Figure 2-3 Elements in the Theory of Planned Behavior (after Ajzen (1991))

2.5.4 The Technology Acceptance Model

A widely known and well tested model for the diffusion of technology is the TAM (Davis 1989; Davis, Bagozzi, and Warshaw 1989). In the 10 years after its introduction, the two journal articles that introduced the TAM (Davis 1989; Davis, Bagozzi, and Warshaw 1989) were cited in no less than 424 journal articles.

Davis' goal in developing this theory was to a) provide a theoretical justification of the determinates of technology acceptance across a wide range of IT applications and populations, and b) to simplify and amalgamate the forces determining attitude towards

adoption into a parsimonious set of factors that would mediate most or all other external variables (Davis 1986). The TAM strives to be both a theory of which and how external factors determine beliefs about technology and a theory of how these beliefs determine adoption. As in the TRA, use is determined by behavioural intention that in turn is influenced by attitude. In contrast to the DIT and TRA, Davis proposed only two constructs as forces in determining attitude and intention: Perceived Usefulness (PU) (the degree to which a technology is considered to be utilitarian) and Perceived Ease of Use (PEOU) (the degree to which the use of a technology is considered to be effortless).

The meaning of these terms comes with the proviso that Davis (1989) only used them in association with the perceptions of individuals. Can models and methods of investigating individual innovation such as the TAM simply be transferred to organisations? When faced with a similar question 27 years earlier, Rogers (1962) said yes and identified hundreds of studies that have been done in this manner. A search of more recent literature will reveal many such papers - for example Kollmann, Kuckertz and Breugst (2009). Please see Chapter 2.5.2 for additional discussion.

According to the TAM, a system that is perceived to be useful and easy to use will invoke an attitude that the technology is valuable, superior to other alternatives and therefore produces an intention to adopt. Venkatesh and Davis (2000) asserted that PU and PEOU mediate other external variables and are themselves correlated. As illustrated in Figure 2-4, PU and PEOU are both proposed to have a positive effect on user attitude.

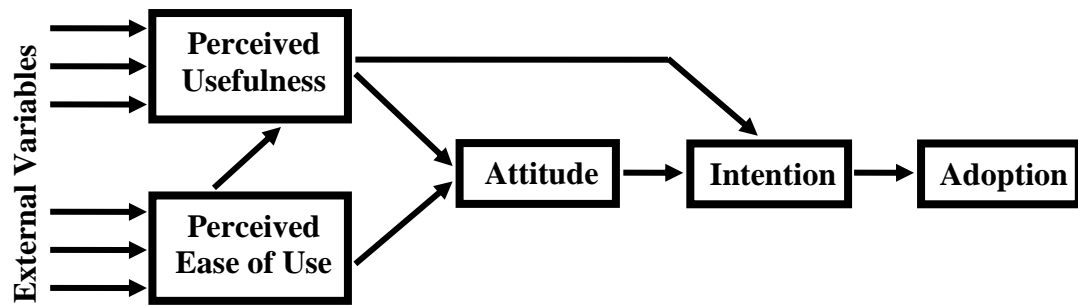


Figure 2-4 Elements in the Technology Acceptance Model (TAM) (adapted from Davis et al. (1989))

2.5.5 Perceived Usefulness

Davis (1989) cites many theoretical influences on his development of the PU construct. These include the works of Rogers (1962, 5th Ed. 2003), Ajzen and Fishbein (1980), Tornatzky and Klein's (1982) meta-analysis which found that only perceived relative advantage, perceived complexity and perceived characteristics were related to adoption, and DeSanctis' cost-benefit analysis of a decision support tool (1983). PU incorporates some of the influences of the DIT model including relative advantage and compatibility. PU also incorporates other positive work place factors such as perception of increased productivity and perception of better work performance and quality.

2.5.6 Perceived Ease of Use

Davis' (Davis 1989) PEOU also incorporates some of the influences of the DIT model including Complexity, Observability and Trialability. PEOU is associated with issues such as the usability of a technology, the cost-benefit relationship of using the technology and the possible improvement in work related efficiency.

2.5.7 The Technology Acceptance Model 2

Prior to examining the efficacy of the TAM, it is necessary to follow its evolution into the ‘combined model’ - the Technology Acceptance Model 2 (TAM2) (Venkatesh and Davis 2000). As previously discussed, Davis incorporated portions of the TRA – which he viewed as a key underpinning of the TAM - into the original TAM theory. Davis did not attempt to incorporate the Subjective Norm construct into the original TAM as he felt it was the least understood of the TRA constructs and there was insufficient evidence available to separate out the direct and indirect effects of Subjective Norm on intention (Davis 1989).

Venkatesh (Davis’ student) and Davis set out to extend and unify the TAM related theories by explaining PU in terms of social influence and cognitive processes – including Subjective Norm (Venkatesh and Davis 2000). The combined model is illustrated in Figure 2-5.

2.5.7.1 Intention

The attitude construct of the TAM was dropped in the TAM2 model. No explanation was given and no explanation for the omission could be located in the literature.

Perhaps the authors felt the term was superfluous in light of the use of the term intention. Many researchers in the field admit the strong association between intention and acceptance to be adequate for one to be a surrogate for the other (Agarwal and Prasad 1999; Chau 2001; Igbaria, Guimaraes, and Davis 1995; Igbaria et al. 1997). In current usage, the terms intention, acceptance and adoption are now often used interchangeably (e.g. Kulviwat (2004)).

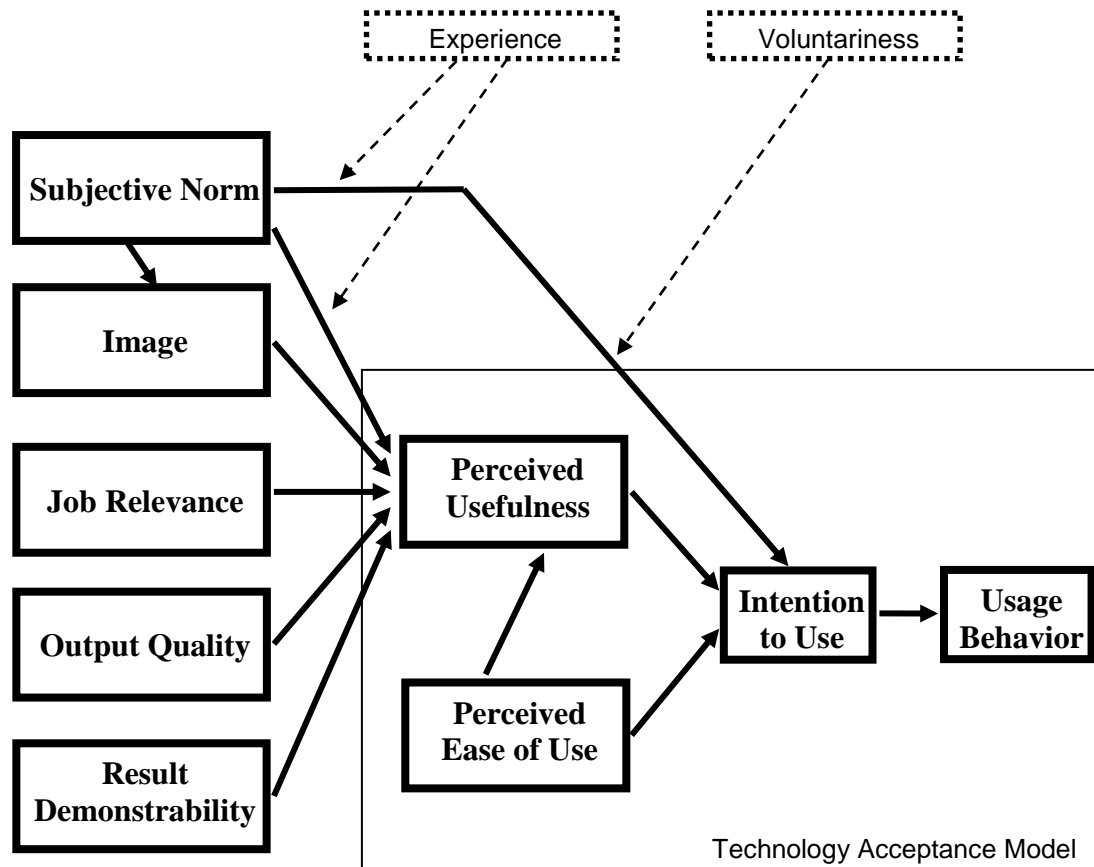


Figure 2-5 Elements in the Technology Acceptance Model 2 (TAM2) (Venkatesh and Davis 2000, p 188)

2.5.7.2 Subjective Norm and Image

The rationale of the inclusion of Subjective Norm (defined in the discussion of the TRA) is that people may choose the adoption of a technology if they perceive their referents as being favourable to its adoption. In an enterprise framework, this rationale may be better understood by practitioners as the notion of an ‘industry standard’ or ‘best practice’. Image is a somewhat different idea and is defined by Moore and Benbasat (1991, p. 195) as ‘the degree to which use of an innovation is perceived to enhance one’s ... status in one’s social system.’

Venkatesh and Davis (2000) theorise, establish from their testing, and provide evidence from their previous research supporting the notion that Image is strongly associated with Subjective Norm. So strongly do they make their case, the two constructs could be considered as a single construct as evidenced by the statistics from their paper: Subjective Norm is correlated with PU with an R^2 value of 0.47, Image is correlated with PU with an R^2 value of 0.21, and Image is correlated with Subjective Norm with an R^2 value of 0.49 (all at the $p < 0.001$ level). While Image is shown to be a significant determinant at the $p < 0.001$ level, it has only half the impact on the variance of PU as Subjective Norm.

2.5.7.3 The Effect of Experience and Voluntariness on Intention

Venkatesh and Davis (2000) cite Hartwick and Barki (1994) as identifying the relationship between Voluntariness and Subjective Norm (later confirmed by their own study). Subjective Norm has a *direct*, positive effect (which decreases with time and experience) on intention when system use is perceived to be mandatory and no effect on intention when system use is perceived to be voluntary. Voluntariness has no effect on PU via Subjective Norm.

2.5.7.4 Job Relevance and Output Quality

Job Relevance is the degree to which a technology is applicable to the task. It is intuitive that a database application will not have much appeal to an illiterate, desert dwelling, tribesperson while a satellite telephone could be very relevant. Output Quality is taken by Venkatesh and Davis (2000) to have a broad meaning as a matching between a user's goals and the success or consequences of using the system. In the initial TAM2

model (Venkatesh and Davis 2000), Job Relevance and Output Quality were identified as two separate determinates with different underlying fundamentals and an argument in that respect is given. In the final model, they are combined with the justification that they were found to be ‘interactive’ – as a technology becomes more relevant to a job, it is perceived as increasing important to job output and quality.

2.5.8 Efficacy of the Technology Acceptance Model

The TAM/TAM2 has been extensively referenced and tested in the literature. In July 2009, a search for ‘technology acceptance model’ (present date to earliest) on Proquest returned a list of 640 publications referencing the TAM. For the same search term, Google Scholar returned 10,300 hits.

Davis (1989) compared TRA and TAM and found TAM superior in predicting intention (47% of the variability explained versus 32%). Mathiesen (1991) compared TPB and TAM and found that TAM outperformed TPB (70% versus 60%). Taylor and Todd (1995) also tested TAM versus TPB (60% versus 51%).

In his thesis proposing the TAM2 theory, Venkatesh cites 14 papers that provide ‘extensive empirical support through validations, applications and replications’ of the TAM that ‘successfully explained about 35% variance in usage intentions and behavior’ (Venkatesh 2000, p 2). Venkatesh goes on to propose the TAM2 theory and describes several comparisons of TAM versus TAM2 that show TAM2 improves the efficacy of TAM by 10-40%. Further support (Venkatesh and Davis 2000) for the superiority of the TAM2 over the TAM cites four longitudinal field studies that provide usage intentions

of 34-52%. Different studies were used by the various researchers to compare the efficacy of the TAM to other theories – which explains the differences in the absolute values of the comparative percentages.

Ssemugabi and de Villiers (2007) and Theng et al. (2008) investigated multimedia e-learning applications and found that as implemented they were useful (PU) and easy to use (PEOU).

2.5.9 Critique

Rogers' book (1962, 5th Ed. 2003), based on many case studies, proposed five attributes of technology acceptance and set the stage for further research. The TRA (Ajzen and Fishbein 1980) identified some general factors determining the adoption of technology (attitudes and Subjective Norm) but suggested that the researchers should select the factors to be tested in each area. The authors did not discuss the choice of factor selection criteria. In addition to theory testing, many studies searched for additional factors to the five proposed by Rogers. The PCI (Moore and Benbasat 1991) extended Rogers' factors to eight and Sanders' (2003) identified leadership, location and affiliation. The existence of so many choices of factors poses the question - what factors should be used?

TAM/TAM2 re-framed the factors and attitudes of the DIT and TRA into variables moderated by PU and PEOU. While it is now generally accepted that PU and PEOU fully or mostly moderate external variables, there have been many attempts in the literature to discredit the TAM/TAM2's claim that PU and PEOU moderate *all* external

variables. Many other external variables have been proposed and tested. Most of these attempts have been without marked success, but there are exceptions – e.g. Developer Responsiveness (Gefen and Keil 1998), Perceived Privacy (Little 2003), Staff Seniority, Age and Education (Burton-Jones 2005) and Perceived Fun (Pijpers and van Montfort 2005).

The TAM/TAM2 theory itself has been subject to attempts to unify it with other predictors. Venkatesh, Davis and Davis' attempt (2003) - the Unified Theory of Acceptance and Use of Technology (UTAUT) - 4 independent variables for intention and 8 independent variables for behavior. In the longitudinal study contained in their paper, the authors claimed the UTAUT accounted for 70% of the variance in usage intention. However, Bagozzi (2007) observed that while the UTAUT was well-meaning and thoughtful, its use of so many variables would lead to splintering and chaos rather than the unification of theories.

The TAM/TAM2 offers one enormous advantage over DIT and TRA in research applications – parsimony. Only the five antecedents of PU (Subjective Norm, Image, Job Relevance, Output Quality and Result Demonstrability) plus PEOU need to be considered. Explaining on average 40% of the variability in adoption, PU has consistently been a stronger predictor of usage than PEOU (Fox 2005; Chismar and Wiley-Patton 2003; Venkatesh and Davis 1996; Ma and Liu 2004). While PEOU may be quantitatively less or even insignificant as compared to PU, when dealing with a technology such as multimedia, PEOU is *qualitatively* of interest.

2.5.10 Relevance

While parsimony may be one of the strengths of the TAM/TAM2, it may also be its chief weakness. The model rests on the linkage between intention and behavior – as though the acceptance was a worthwhile attainment in itself. Bagozzi (2007) agrees with this limitation and cites IT as an example where a technology is adopted for the purpose of more accurately and efficiently carrying out a task than can be obtained from other methods. By focusing on PU and PEOU, the TAM ‘slights the benefits of use and their actual attainment’ (Bagozzi 2007, p. 245). Others have similar reservations about the usefulness and depth of TAM/TAM2 results - ‘In retrospect, we observe that the model provides *relatively few implications* for management for *implementing new technology*. It also seems to have discouraged further *process studies* with the majority of work on implementation found to employ *survey methods only*.’ (Lucas, Swanson, and Zmud 2007, p. 206-7) (emphasis added).

The TAM/TAM2 provides a useful means of explaining the PU and PEOU *beliefs* formed *prior* to and influencing adoption. In the case of PU, these beliefs are determined by the influence of the variables Subjective Norm, Image, Job Relevance, Output Quality and Demonstratability. However, as observed by Venkatesh (2000, p 344), ‘...most models [of adoption] help prediction but do not provide sufficient understanding to allow the design of specific interventions to foster acceptance and usage.’ As stated in Chapter 1.3.1, one of the aims of this research is to design better organisational interventions and increase user acceptance and usage of systems. Therefore, investigation of TAM/TAM2 constructs and variables in the post-adoption domain is both appropriate and desirable. For example, the pre-adoption belief that geo-thermal wells will produce useful amounts of electricity is replaced by post-adoption,

actual mega-watt/hours. Investigating post-adoption usefulness and ease of use provides an opportunity for research to extend the TAM/TAM2 concepts into implementation and ask to what uses was the technology put? How easy is the technology to use in practice?

The practice-oriented research as posed by Q1.0 in Chapter 1.3.2 and reported in Chapter 4 describes in detail how multimedia OHSE inductions have been implemented. While the variables moderated by PU in the pre-adoption domain are addressed in the following research questions, PU as a pre-adoption belief construct is not specifically investigated. In the post-adoption domain, the pre-adoption PEOU belief construct translates into actual ease of use as addressed in the following research question.

In relation to the main research question Q0, we therefore ask:

Q4.1 To what extent have multimedia OHSE inductions been easy to use?

Q4.2 In what ways and to what extent have Subjective Norm, Image, Job Relevance, Output Quality and Demonstratability been influences in the adoption of multimedia OHSE inductions?

Q4.3 What is the intent for future adoption of multimedia OHSE inductions?

2.6 ADOPTION: MEDIA RICHNESS

2.6.1 Introduction – Equivocality and Uncertainty

Why do organisations process data? The answer most commonly given in the literature is that organisations collect and process data to reduce uncertainty (Weick 1976). Why do organizations train? The answer most commonly given in the literature is that organizations train to reduce uncertainty and remove equivocality (Daft and Lengel 1986). Uncertainty and equivocality are therefore at the root of organisational training.

Uncertainty and equivocality may at first appear similar. Uncertainty can be reduced by obtaining and processing additional data. The uncertainty associated with the question, What time does the airplane arrive?, may be reduced by referring to the flight schedule, receiving a telephone call from someone boarding the aircraft at the departure location, contacting the flight information centre for the airline, and so forth. Equivocality contains a twist – data may not be clear or may be interpreted in more than one way. Additional data may not be able to resolve the related uncertainty and may in fact increase it (Daft and Lengel 1986). In response to the uncertainty, At what time does Mr. Jones arrive on the airplane?, equivocality and ambiguity may arise when additional data indicates that more than one Mr. Jones on more than one airplane may be arriving at similar times. Does arrival mean when the airplane touches down on the runway, when the airplane is on the taxiway, when the airplane arrives at the terminal gate or when Mr. Jones steps off into the terminal?

In response to equivocality, organizations enact general rules and policies. Rather than attempting to resolve the equivocality by the collection of additional data (which may

not be helpful), management creates or defines rules that are passed on to staff as training and policy. For example, ‘Please have newly arriving personnel call at the service desk.’ (Weick 1979). Figure 2-6 illustrates the relationship between uncertainty and equivocality.

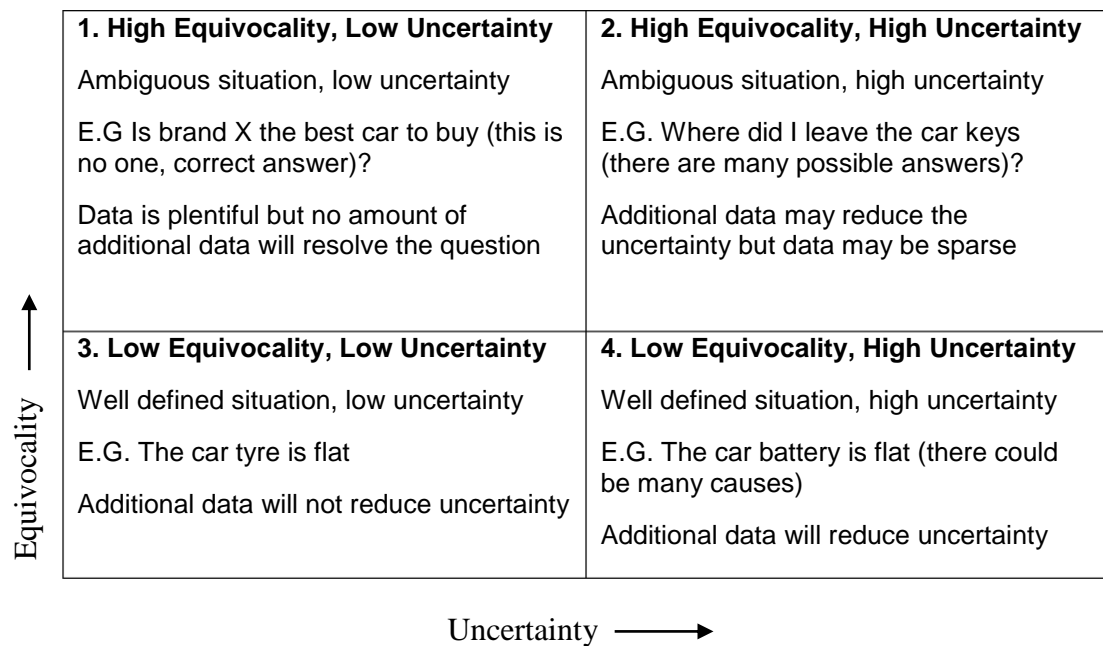


Figure 2-6 Uncertainty-Equivocality Relationship (after Daft and Lengel 1986)

2.6.2 Media Richness Theory

The question that follows from the examination of uncertainty and equivocality in training is What media best reduces uncertainty and equivocality? Daft and Lengel (1986, 1987) proposed the Media Richness Theory (MRT) to explain the selection of media. This theory posits that managers select a media for communication based on the ability of the media to avoid equivocality. The perceived ability of media to overcome equivocality is based on its ‘richness’. Richness is defined as the ability of a media to change understanding within a time interval (Daft and Lengel 1986, p. 560). Richness factors include feedback synchronicity, capacity to transmit multiple cues and clues,

language variety and personal focus. Feedback synchronicity allows rapid convergence on a common understanding. Multiple cues and clues facilitate understanding (gestures plus body language plus tone of voice, etc.). A variety of language usage such as written text, spoken dissertation (live or recorded), numbers and formulae, indexes etc. all aid understanding. A sense of personal conveyance and personal focus provides individual perspective. On the richness scale, face-to-face, with its ability to contain many social clues and the opportunity for immediate feedback, has been rated highest by many authors from Daft and Lengel (1986) to Lee, Cheung and Chen (2007).

The hierarchy of media richness has been built up from written formats to include electronic media and is ranked highest to lowest as face-to-face, telephone, web site, email and written documents (Daft and Lengel 1987; Webster and Trevino 1995; D'Ambra 1995; Webster, Trevino, and Stein 1996; Vickery et al. 2004; Caspi and Gorsky 2005). The classification of this breakdown has generally been limited to the media name, text or voice, level of feedback synchronicity, and degree of personal presence. Bersen (1995, 1997) offers an exhaustive and exacting taxonomy of modalities that could be employed to describe the content and channels used for media delivery. While explicit, the technical nature of Bersen's taxonomy is not entirely suited to the discussion of media richness. However, borrowing Bersen's modal channels (auditory, visual, haptic), and adding social clues, personal presence and feedback synchronicity, allows Table 2-2 to provide an enhanced comparison of media richness.

The ranking of media in this table is open to interpretation but generally follows the literature. Rather than using the technical taxonomy of Bersen, the table uses more descriptive terms such as 'movie'. Haptics as a modality is not included as being outside

Table 2-2 Media Richness Hierarchy (after Daft and Lengel 1987; Webster and Trevino 1995; D'Ambra 1995; Webster, Trevino, and Stein 1996; Vickery et al. 2004; Caspi and Gorsky 2005)

Media	Visual Channel	Auditory Channel	Social Clues	Personal Presence	Feed-back
Face-to-Face	Live Vision Pictures Graphics	Live Voice Background Noise	Gestures Body Language Tone of Voice	Very High	Very Fast
Video Conferencing	Live Video Limited: Pictures Graphics	Live Voice	Gestures Body Language Tone of Voice	Very High	Very Fast
Telephone Call/ Conferencing	Nil	Live Voice	Tone of Voice	High	Very Fast
Video Recording	Movies Sub-titles Sign-language Pictures Animations Graphics Labels/Keywords Text	Voice Voice-over Music Background Noise Sound Effects	Gestures Body Language Tone of Voice	Medium	Very Slow
Web Site	Movies Sub-titles Sign-language Streaming Video Pictures Animations Graphics Text Labels/Keywords Index Translations URL/Attachment	Voice Voice-over Music Sound Effects URLs Attachments	Tone of Site Tone of Text	Low	Very Slow
Social Networking	Movies Sub-titles Sign-language Pictures Text Labels/Keywords Index URL/Attachment	Voice Voice-over Music URL Attachment	Gestures Body Language Tone of Voice Tone of Text	Medium	Slow
Electronic Mail	Text Limited: Pictures Graphics URL/Attachment	URL Attachment	Tone of Text	Medium	Slow
SMS & Instant Messaging	Text Limited: Movies Pictures	Nil	Tone of Text	Medium	Slow
On-line Forum	Text Limited: Pictures Graphics URL/Attachment	URL Attachment	Tone of Text	Medium	Slow
On-line text chat	Text	Nil	Tone of Text	High	Fast
Voice Mail	Nil	Voice	Tone of Voice	High	Slow
Written Letter	Text	Nil	Tone of Text	High	Very Slow
Printed Document Facsimile	Text Labels/Keywords Index Pictures Graphics	Nil	Tone of Text	Very Low	Very Slow

the scope of media being examined. Bersen's taxonomical distinction between static and dynamic modalities (static being present for examination until passed over, dynamic being presented fleetingly) is also not used as 'dynamic' can too easily be misinterpreted as 'animated'.

2.6.3 Support for MRT

MRT has been supported in a large number of studies (Lee, Cheung, and Chen 2007; Fulk and Collins-Jarvis 2001). Robert and Dennis (2005) reported that the richer the distance education environment, the higher the course was rated by students. Sun and Cheng's (2005) findings also support the use of rich media in instructional materials. However, MRT has received less support in laboratory studies (Dennis and Kinney 1998; Mennecke, Valacich, and Wheeler 2000).

Equivocality, ambiguity and uncertainty are not the only measures proposed as selection criteria for the choice of media. A number of authors (Lee 1994; Markus 1994; Webster, Trevino, and Stein 1996) have presented evidence that social influence, peer attitudes and social climate are strong predictors of media choice. Jourdan (2006) found that a media's synchronicity was more influential in shaping the perception of physical presence than media capacity. In a study of 12,398 students, Timmerman and Kruepke (2006) found that only personal focus had a significant bearing on student performance and then with an R^2 of only 1.44%.

2.6.4 Critique and Relevance

OHSE training contains an element of immediacy missing in much other training.

OHSE training is aimed at behavior in the real world. When confronted with an OHSE situation, the trainee is not being asked to remember how to derive the 3rd root of an equation, they are being asked *to take some action*. And the action they are being asked to take is generally not open to interpretation. In this sense, one goal of OHSE training is to dispel ambiguity from very certain and well defined actions. For example, the training may be aimed at engendering the behavior of broadcasting ‘Emergency, emergency, emergency’ on radio channel 22 whenever there is an accident. Where is the ambiguity or equivocality in this? The action does not have more than one alternative. However, the ambiguity arises ‘...when there is a difference between the individual frame of reference and the negotiation required to reach a shared understanding.’ (Lee, Cheung, and Chen 2007, p. 2067). The training must dispel the idea that saying ‘Mayday, mayday, mayday’ is permitted, or that broadcasting on any channel but 22 is allowable, or that if a telephone is handy it should be used instead of the radio, or that ‘accident’ means only an automobile accident, and so forth.

Another issue of ambiguity is the order of actions. For example, in a situation where a worker has been injured by an exploding oil pipe that is now on fire and spilling hydrocarbons into a natural water course that hosts an endangered species - what should an assisting person do first? At what risk to the injured party, the person assisting, other persons in the area, the plant and equipment and/or the environment? The data is certain but the answer is unclear – at least without unambiguous training.

In Table 2-2, no mention is specifically made of multimedia. It can be seen that multimedia encompasses attributes of the both video recording and web sites. Further, video recording is ranked above web sites apparently on the basis that web sites cannot deliver video. Taking into account the increasing bandwidth of the internet and the current delivery capabilities of video codecs, this is no longer the case. It could therefore be suggested that multimedia should replace ‘web sites’ (with web sites being just one method of delivering multimedia) and that multimedia should be ranked above video recordings.

In the literature, face-to-face delivery of information is always, and without questioning, ranked as the richest media. The potential fallacy of this assumption is that in face-to-face situations, the same or different individuals may not always deliver the same message in the same manner thus creating rather than eliminating equivocality.

In the present study, we examine a group of adopters who have a message concerning OHSE actions and behaviors where equivocality is of extreme, possibly life-threatening importance. These adopters have chosen multimedia over existing face-to-face, classroom delivery.

In relation to the main research question Q0, we ask:

Q5.0: In what ways and in what manner is multimedia better able to dispel uncertainty and reduce equivocality as compared to face-to-face delivery of OHSE inductions?

2.7 ADOPTION: DUTY OF CARE

2.7.1 Introduction

One of the proposed forces for adoption of multimedia OHSE inductions is the need to conform to Duty of Care (DOC) legal requirements. In order to understand the breadth and implications of DOC, it is necessary to understand its legal basis. DOC has both a common law and civil law component. Common law is based on the principle of deciding cases by a combination of the common practice of the people and reference to previous legal decisions called precedents. The precedents themselves are the law. When faced with a case in common law, the litigants and judges discover the facts in open court, consult precedents and based on these, a decision is rendered. If the facts discovered in the case differ substantially from the facts of previous precedents, the judges are free to make new rulings which then become common law.

Statute laws are drafted by legislative bodies and have their source in ancient Roman codes. Civil judges resolve disputes by referring to statutory principles arrived at in advance by legal scholars and legislators. Judges are not expected to use discretion or make new law. Civil cases are generally heard in private before judges rather than by juries (*Encyclopedia Encarta*).

Within the common and civil law, there are further legal concepts that apply to DOC – the law of torts, contract law and fiduciary duties. The law of torts is the law of wrongs and compensation ('If a man's ox gores another ox ...'). The law of contracts can place particular requirements on the parties - for example the employer agrees to supply underground smoke alarms - that can result in recourse to the law of torts if not

completed. Fiduciary duties arise from the concept of stewardship (*Encyclopedia Encarta*).

In English common law, the fiduciary duties of a company director acting as a steward for the shareholders are the Duty of Care, Duty of Loyalty, Duty of Candour/Disclosure and Duty of Good Faith (Grossman 2007). Australian fiduciary DOC has its basis in English common law (Cassidy 1995). DOC common and statute law form the core of OHSE legal requirements.

The obligations placed on a company by DOC may be divided into two sections – those placed on the directors of a company via common law and those placed on the body corporate by statute law. As summarised by Cassidy (1995), the original DOC obligations placed on the ‘country gentleman’ director were remarkably low. Directors were required only to do the best they could. It was assumed that directors were benevolent, country gentlemen amateurs lacking any particular technical skill. It was held that the stockholders were responsible for the quality of the directors they chose. However absurd the conduct (of both omission and commission), as long as it stayed within the corporate charter it was considered the misfortune of the company’s choice of directors. The director was only expected to exercise the knowledge and skill appropriate to the director’s knowledge and experience. ‘Hence, the common law test requires directors to do only as much as one might fairly expect someone as stupid and as incompetent as the director happens to be’ (Cassidy 1995, p. 3). This position of the common law allowed directors to manage companies essentially free from fear of prosecution.

2.7.2 Recent Australian Legislation

Australian statute law was introduced in 1995 to provide a more rigorous standard to the previously lax common law DOC (Cassidy 1995). Corporations Law, Section 232(4) and (25) now imposes on a director a duty to conduct the company's affairs with due diligence and to '... the degree of care and diligence that a reasonable person in a like position in a corporation would exercise in the corporation's circumstances' (Cassidy 1995, p. 4).

In the arena of statute law, Section 232(6B) and 1317DA also provide for civil penalties for directors who knowingly or recklessly breach the DOC provisions of the act. DOC legislation, as it applies to OHSE, is further fragmented by six state acts, two territory acts and two commonwealth acts (Loosemore and Andonakis 2007). In New South Wales, the OHS Act 200 and OHS Regulation 2001 have significantly simplified and amplified the OHSE legal scene. These acts impose heavy fines and custodial sentences on persons or organizations who contravene their provisions. Recently, all Australian states have increased sanctions against workplace fatalities. New South Wales, Victoria and Western Australia may now impose jail terms and the Australian Capital Territory has introduced a crime of industrial manslaughter (Loosemore and Andonakis 2007).

As an example of state based OHSE DOC statutes, the NSW OHSE Regulation 2001 Part 8.2 imposes obligations on employers of construction workers that require the company to provide OHS training and inductions prior to commencement of work on site. This training is divided into general, work activity and OHSE training. General training is compulsory and covers areas such as safety signage, management

requirements, basic OHSE principles and practices. General OHSE training is provided by state certified WorkCover trainers and results in a 'Green Card'. Work activity training is also delivered by certified WorkCover trainers. This training covers more specific areas such as hazardous material handling, risk management systems, and legislative responsibilities. Inductions are designed to give an employee entering new site information about OHSE issues specific to that site. There is no requirement that the training be documented, approved or delivered by a certified trainer.

2.7.3 Mandatory Adoption

Common and statute law place certain DOC obligations on enterprises that are not voluntary. The role of voluntariness in the formation of an intention to adopt new technology is discussed in Chapter 2.4.7.3. In summary, when adoption is seen as mandatory, Subjective Norm has as influence on adoption – otherwise not. This effect is diminished over time. PU is not affected by Voluntariness (Hartwick and Barki 1994; Venkatesh and Davis 2000). Companies therefore view the adoption of mandatory technology as necessary to conform to industry standards but do not necessarily view the adoption as useful.

2.7.4 Sarbanes-Oxley

In response to a number of accounting scandals and corporate collapses, the U.S. Congress enacted the SOX act eight months after the fall of Enron and only nine days after the collapse of WorldCom. The Congressional record is replete with references to the improprieties and omission of the directors as regards accounting and reporting

practices (Grossman 2007). These improprieties and the requirement for more transparent and accurate reporting are the target of SOX.

As many Australian companies are subsidiaries of U.S. companies, SOX is sometimes discussed in relation to corporate DOC. The DOC addressed by SOX is only in relation to accounting and reporting practices, not OHSE. The SOX equivalent Australian legislation is the Corporate Law Economic Reform Program Act 2004 commonly known as CELRP 9.

2.7.5 Critique and Relevance

The SOX legislation has no direct bearing on adoption in Australia except for reporting requirements of Australian subsidiaries American companies. The mandatory common law and legislative aspects of individual director and corporate DOC relate directly to one of the core questions addressed in this research.

In relation to the main research question Q0, we ask:

Q6.0: In what ways and to what extent has DOC been a factor in the adoption of multimedia OHSE inductions?

2.8 POST ADOPTION: PROFITABILITY-PRODUCTIVITY PARADOX

2.8.1 Introduction

‘You can see the computer age everywhere but in the productivity statistics.’ (Solow 1987, p 36). With this remark, economist and Nobel Laureate Robert Solow sparked what may be the world’s longest time line of IT/economic research – the now named ‘Productivity-Profitability Paradox’ (PPP). Does investment in IT generate higher productivity or profits? If so, where is the evidence? If not, why not? After twenty years of follow-up studies, the answers remain elusive with papers mentioning the PPP still being published at the rate of approximately one per month (2006-2010, Proquest & Science Direct).

Productivity is obtained by investment in traditional and labour capital – adding either more barges or more slaves builds more pyramids more quickly. Historical productivity measured as the percentage change in non-farm production per man hour of labour in the U.S.A is shown using a five year moving average in Figure 2-7.

Unless otherwise noted, the economy being described in the following discussion is that of the U.S.A. and the values are for U.S. dollars.

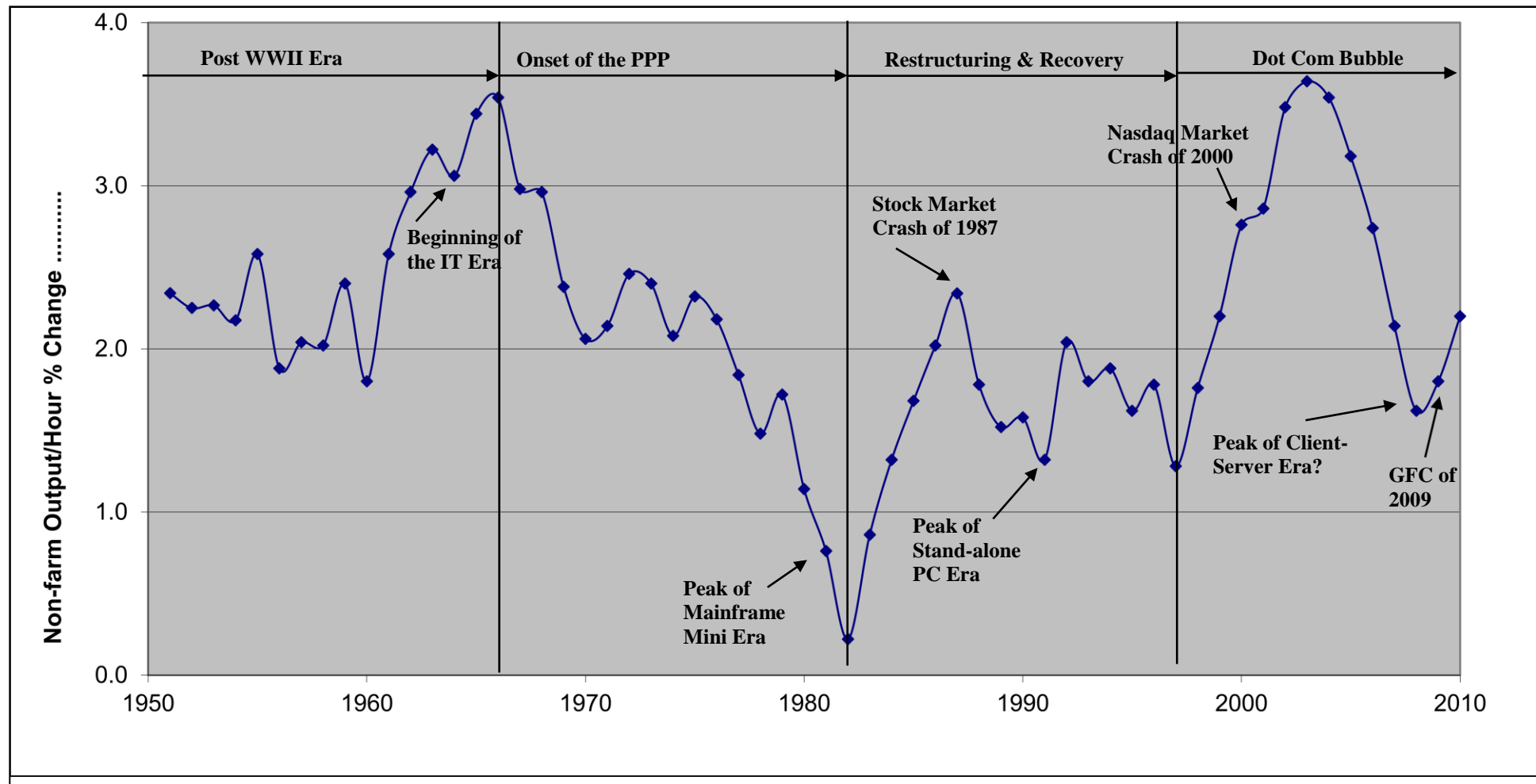


Figure 2-7 Non-Farm Output/Hour % Change previous Year 5 year Moving Average US Bureau of Labor Statistics

2.8.2 The Existence of the Profitability-Productivity Paradox

A discussion of the PPP's existence is often a matter of 'now you see it ... now you don't' due to changing productivity levels. For the purpose of comparison, a number of hypothetical 'eras' have been superimposed on Figure 2-7. In the post WWII era, productivity grew at an average rate of 2% per year. Capital investment in IT this era was insignificant as there were only 2,500 computers in use in 1958 increasing to 18,000 in 1964 (*History in the Computing Curriculum*). The WWII era is used as a basis for productivity comparison to later eras.

The start of the modern IT era may be defined in a number of ways, but the introduction of the IBM 360 series mainframe computer and the ascendancy of the COBOL programming language in 1964 is a convenient point (Willcocks and Lester 1999). Accounting, banking/financial and inventory programs headed the list of mainframe applications. The slowdown of productivity growth that is coincident with the growth of IT investment has become central to the PPP debate.

In reviewing the book *Manufacturing Matters* (Cohen and Zysman 1987), economist and Nobel Laureate Robert Solow made his now famous observation that 'You can see the computer age everywhere but in the productivity statistics' (Solow 1987, p. 36). In the same year, Steven Roach (1987) sought explanations for the productivity down-turn and questioned the impact of computers on economic performance. Roach and Solow are jointly credited with identifying the PPP.

An early attempt to validate the existence of the PPP by Alpar and Kim (1990) was inconclusive but Berndt and Morrison (1991) found that almost all of the 1968-1986 measures showed that the payoff for IT investment IT fell short of the mark. They concluded that capital would be better spent in other ways such as new buildings.

Leading up to and following the 1987 stock market crash, the productivity figures recovered to near post WWII levels. This prompted a major challenge to the existence of the PPP by Brynjolfsson and Hitt (1993, 1996) whose papers became central to the debate. From a study of firms for the period 1987-1991, they concluded that the PPP, if it had existed at all, had disappeared by 1991. The authors attributed the growth in productivity to a 60% - later upgraded to 81% - per annual return on IT investment. The authors acknowledged that several other studies had failed to find any increase and attributed their own findings to the use of larger data sets from a more recent time period, different and more detailed firm-level data than had been previously available, and to data consisting entirely of relatively large 'Fortune 500' companies.

Brynjolfsson and Hitt's assertion that the PPP had disappeared by 1991 was challenged by a number of researchers. Roach (1991, 1998) observed that a massive wave of service sector restructuring was undertaken in the 1980-1990s, that IT had lumbered service industries with fixed costs with no gain in productivity and attributed the increase in productivity to good old fashioned cost cutting and outsourcing. Solow (1998), looking at the annual growth in productivity figures for the period 1979-96 (1.4%), observed 'That does not exactly look like the explosion of productivity growth one might have expected from the transformation of the world by computer.' (Solow 1998, p 120). Neither Sichel (1997) nor Solow (1998) found evidence of Brynjolfsson's

(1996) high returns on IT capital. Rai, Patnayakni and Patnayakuni (1997) found no effect on return on investment (ROI) for any type of IT investment.

Using Brynjolfsson and Hitt's (1996) and Lehr and Lichtenberg's (1997) data sets, Dewan and Min (1997) concluded that IT capital, ordinary capital, and labour capital were all substitutable. Strassmann (1998) also did not find productivity gains and backed his argument with the fact that \$1 worth of staff cost in banking in 1989 produced \$5.30 worth of revenue while the same \$1 in 1996 produced only \$2.80. Fahy (1998) reviews the PPP and summarises that a) computers are basically a 'dud' in terms of productivity growth, b) computers sometimes had unforeseen and undesirable results, c) investment in IT had continued at an increasing rate irrespective of results, d) some results of IT may in fact have been counterproductive, and e) even when used appropriately, productivity was initially lower and only if complex organisational changes were implemented would productivity increase. Fahy made the insightful observation - later taken up by Strassmann (2004b) - that performance enhancement is more common than increases in productivity or profitability.

In response to their critics and using data from 1,216 firms over 11 years (1987-97), Brynjolfsson, Hitt and Yang (2002) changed course to focus on the complementarity of investment in IT and investment in intangible assets such as human capital, business decentralisation, team-oriented production and decision rights. The authors found their hypotheses supported by evidence that each dollar of IT investment (over other types of capital) substantially increased the stock market value of a firm, and vice versa, that firms with the highest market value also had higher levels of investment in both

intangible human and business IT capital. This hypothesis that investment in IT improves stock market value is discussed in Chapter 2.7.3.2 and shown to be disproved.

During the Dot Com era, productivity figures again rose. One of the features of this era was the meteoric rise and fall of the value of IT related stocks. Brynjolfsson, Hitt and Yang's (2002) assertion that each dollar of IT investment substantially increased the stock market value, and vice versa, must have been challenged by the fact that huge amounts of value were wiped off the Dot Com enterprises who were the biggest users of their own IT technology.

In more recent times, a number of authors have conducted reviews of the data over various periods up to the mid-2000s and concluded that the PPP has not been adequately refuted (Triplett 1999; Dedrick, Gurbaxani, and Kraemer 2003; Melville, Kraemer, and Gurbaxani 2004; Ahituv and Greenstein 2005; Byrd et al. 2006; Ross and Ernstberger 2006) .

2.8.3 Explanations of the Profitability-Productivity Paradox

Despite the lack of evidence that IT provides any productivity or profitability returns, capital spending on IT is high. From 1993-1996, IT investment increased by an average of 8.5% per annum (Roach 1998) with investment in 1997 in excess of US\$220 billion per year. More than 50% of total annual capital investment in 2002 was in IT (King 2002). In 2008, IT spending world-wide exceeded US\$2 trillion (Applegate, Austin, and Soule 2009). 'Despite the sceptics, no one is advocating that enterprises refrain from investing in IT.' (Hayward, Magrassi, and Roberts 2002, p 3). Why is this so? The

debate has been driven by the feeling that there just has to be an explanation – pragmatic businesses could not be so stupid as to continue investing in something that produced little if any ROI. The explanations put forward may be grouped into categories and named as the measurement problem, intangible assets, management issues, time lags, redistribution and capital affects discussed below.

2.8.3.1 The Measurement Explanation

Brynjolfsson (1993) noted that the measurements used to determined productivity were not accurate with statistics from the service sector (which owned the majority of the IT capital) being notoriously difficult to obtain. Griliches (1994) was unequivocal in his opinion that the problem was in the measurement. Sichel (1994) and Roach (1994a) didn't agree and concluded that measurement errors were small and could not explain any significant portion of the PPP. Roach (1998) reversed the measurement debate by noting that number of hours worked per week rose from 40.6 in 1973 to 50.8 in 1997 - far short of the 35.5 hours used in the productivity measurements since 1988.

Forty five years of measurements are available and the productivity and profitability increases are still elusive. Whatever benefits investment in IT brings, it can safely be concluded from the literature that it isn't productivity or profitability at the macro, micro, or firm level.

2.8.3.2 The Intangible Assets Explanation

Brynjolfsson (1993) and with Hitt (1998) proposed that traditional definitions of *value* may not be adequate to measure the IT effect. In their opinion, IT typically increased quality, variety, customer service satisfaction, speed and responsiveness. These factors were poorly accounted for in the production statistics. The introduction of ATMs were a case in point – the productivity of bank office staff decreased (Little 2003).

Strassmann (1999b) showed how attempting to dismiss the PPP by re-defining enterprise value could go astray. He reported the activities of ‘a leading IT magazine’ whose answer to the PPP was to rank 500 corporations according to an ‘innovation rating’. Corporations engaging in e-business, enterprise-resource-planning, data mining, corporate internet portals, etc. were ranked highest. Strassmann compared the top 45 firms in the innovation list to the bottom 45. The bottom 45’s annual income outgrew the top 45’s by 18.3% to 15.4% and the five year income growth by 14.8% to 14.3%. There were similar results for the five-year net equity and employee growth.

Brynjolfsson (1993) and with Hitt (1998) suggested that for every \$1 of tangible assets derived from investment in IT capital, there must be another \$9 of intangible assets created. If true, the research necessary to validate this position does not appear in the literature.

Lapointe, Mignerat and Vedel (2011) surveyed the success of IT in health care and found that investment in IT systems has never been greater (not less than 2.6-6% of budgets), however there is growing concern about the lack of positive outcomes. In one case study, an administrator complained that the IT system had cost the hospital a

million dollars and they were still trying to figure out how to finance it. In an attempt to explain the PPP, the authors propose re-casting the success of IT systems into a matrix of stakeholder outcomes/benefits. They note the difficulty with this approach is accurately identifying the perspectives and anticipations of the stakeholders.

2.8.3.3 The Management Issues Explanation

Brynjolfsson (1993) thought that managers may have continued to invest in IT without proper management. In two articles, Roach (1994b; 1994) agreed and identified management complacency as a likely cause of the PPP. Likewise, McNee (1996) believed that the recent productivity gains were due to changes in organizational policies, procedures and work processes. King (2002) suggested that firms that had successfully developed IT capabilities had been able to re-structure the 'business process'.

Good management of IT investment goes hand in hand with good enterprise management and between the two, enterprise value is realised. This complimentary affect should appear in the stock price. Tam (1998) found that IT investment was not correlated with a number of stock performance ratios, shareholder's return, or stock value. Bharadwaj, Bharadwaj and Konsynski (1999) studied stock prices and found that value versus IT investment declined between 1987 and 1993. Hall (1993) reported similar results. The research in the literature shows that there is no link between IT investment and stock price.

2.8.3.4 The Time Lags Explanation

Brynjolfsson individually and together with Hitt (1993; 1996; 2003) strongly attributed the lack of emergence of IT related productivity to time lags. The authors wrote that a pattern of low initial returns was consistent with the learn-by-using paradigm and contended that the long term benefits (3-5 years) of IT investment are 2-8 times greater than the short term (1 year) gains. Major productivity gains from the electrification of factories did not occur for 20-40 years (David 1990). This argument was not supported by Hayward, Magrassi and Roberts (2002) who advised their clients that IT investment contributed only 0.3-0.5% per year to productivity versus 0.75% per year for electrification. Sichel (1999) supported this low figure with a value of 0.23% per year for the period 1971-1998.

Eliasson, Johansson and Taymaz (2004) proposed three time-lag paradoxes: 1) long periods of investment in technology with no result (PPP), 2) the unexpectedly sudden surge in growth that appears out-of-the-blue - followed by a crash (Dot-com bubble), and 3) a shift to a new economy that never occurs despite technological abundance. Sweden provided an example of paradoxes #1 & #2 where it took 50 years for Sweden's Labour Productivity (LP) to start to improve after the start of the industrial revolution. Paradox #3 was illustrated by the fact that many countries never experienced any change in LP during the industrial revolution.

Amendola, Gaffard and Saraceno (2005) proposed that the shock of a new technology throws the economy out of balance with the initial effect of reducing productivity and employment. Productivity then lags due to the learning of new skills, shortage of skilled

people and construction. However, once the delays are over, and the equilibrium restored, the full potential of the new technique will become evident. When some gains did appear, supporters of the time lag explanation were vindicated. When the gains subsequently disappeared, no research appeared in the literature to suggest that this was also a time lag affect.

2.8.3.5 The Redistribution Explanation

Brynjolfsson (1993) proposed that the returns on IT investment may be redistributed to benefit some privately at the expense of others publicly such as the absorption of cost rises. Hayward, Magrassi and Roberts (2002) suspected that benefits seemed to flow to consumers rather than enterprises in the form of lower prices, better quality and wider choice of products. This created the impression that firms could not do without IT.

Another concept in the redistribution debate is organisational 'slack' that is easily recognised as bloated staffing, complex paper work and wasted spending. Investment in IT may have taken up organisational slack rather than directly improving the bottom line (Brynjolfsson 1993; Brynjolfsson and Hitt 1996; Dehning, Dow, and Stratopoulos 2003). The manufacturing sector but not the services sector showed some decreased slack after investing in IT (Dehning, Dow, and Stratopoulos 2003).

If a computer replaces 20 employees that are then assigned to other duties not directly related to generating profit (organisational slack), the effect will hit the bottom line - but in the wrong column. Redistribution may occur where an IT system provides an improvement in quality or operations, maintains a firm's competitive edge, passes on

cost savings to its clients or avoids a price rise. This premise is well founded but requires a body of research to support it.

2.8.3.6 The Capital Effects Explanation

Dewan and Min (1997) tested Brynjolfsson and Hitt's (1996) and Lehr and Lichtenberg's (1997) data sets and concluded that IT capital, ordinary capital and labour capital were all substitutable. This finding was supported by Dewan and Kraemer (1998, 2000), Gurbaxani, Melville and Kraemer (1998), Fenn and Linden (2001), Melville, Kraemer and Gurbaxani (2004). Osei-Bryson and Ko (2004) also re-examined Brynjolfsson and Hitt's (1993; 1996) data sets where it was claimed that IT ROI was as high as 81% per annum. Their results suggested that below 12% IT investment there was no increase in output, while above 30%, output actually decreased. Lin and Shai (2006) found decreasing returns on IT investment irrespective of the level of investment.

Rai, Patnayakuni and Patnayakuni (1997) suggest that the lack of impact of IT capital on ROI may be due to the fact also noted by Strassmann (1988) that 80% of a company's IT budget is spent on maintaining existing systems. For equipment, an even larger percentage is involved due to high depreciation and rapid replacement cycles. The literature shows that investment in IT capital has been no more effective – and sometimes less effective – than other forms of capital.

2.8.3.7 The Information Productivity® Explanation

Strassmann (2001a) studied 3,000 European companies in depth (the study period was not specified) to show that IT investment and ROI were not correlated. Strassmann (2004b, 2004c, 2004d) then put forward the Information Productivity® explanation of the PPP in a series of articles where he described his lifetime investigation of the problem. He showed that transaction costs (cost of sales and administration) remain in a relatively small range while profit, cost of goods and cost of sales all show great variability. He further found that transaction cost had a significant correlation to IT spending and concluded that firms deploy IT to control their transaction costs. He reasoned that this was the reason why IT investment was not correlated to profit by firm, industry or sector.

Strassmann went on to define Information Productivity® as the output of a firm divided by the transaction costs. This statistic allowed the focus of investigation to remain on IT and transactions rather than on differing tax regimes, asset costs, capital costs, etc. all of which directly affect profit. Graphing the distribution of Information Productivity® produces a classic normal distribution as opposed to the random scatter plot of IT investment and profit.

Strassmann formulated a number of 'laws' to focus his findings: IT spending and profitability are unrelated (the PPP supported), profit comes from low cost transactions, IT spending is directed towards reducing transaction costs, transaction costs are unique to the firm and the correct level of IT spending cannot be derived from public data - hence the inability to resolve the PPP from economic statistics. Until the advent of the

Does IT Matter? proposition discussed in the following section, there have been few papers challenging Strassmann's work.

2.8.3.8 The 'Does IT Matter?' Explanation

Carr (2003) published an article in the influential *Harvard Business Review* that marks the start of the 'Does IT Matter?' debate. Carr made the following assertions: as IT is a commodity that is easily acquired, it does not offer any competitive advantage, IT will be homogenised thereby dooming proprietary applications, existing IT capabilities are largely sufficient, widespread adoption of 'best practice' software makes IT-based advantages disappear *for everyone*, IT technology is reaching saturation and IT risks now exceed IT advantages. To Carr, IT is a commodity similar to electricity - it is the same product for everyone, there are no barriers to entry or use, it is only how IT is used that makes a difference.

Carr's proposition received much criticism from many sources – some on a conceptual basis such as 'The argument that IT Doesn't Matter goes something like this. Kidneys don't matter ... Just about everyone has kidneys ... There is no evidence that CEOs with superior kidneys are more successful than CEOs with average kidneys. In fact, CEOs who spend more on their kidneys often don't do as well' (Alter 2003, p. 14). Other criticisms of Carr were made on a factual basis such as Strassmann's assertion that Carr offers no actual evidence or research for his propositions and in fact ignored much research to the contrary (Strassmann 2003).

2.8.4 Critique and Relevance

When discussing the financial aspects of IT in general and multimedia as employed in OHSE inductions in particular, there are three distinct but related aspects: cost effectiveness, efficiency and profitability. Cost effectiveness is concerned with short term ROI – e.g. it was more cost effective to send the delegates by bus rather than by train because the cost per person was less. Efficiency is concerned with the effective use of resources – e.g. by using buses rather than trains, we were able to transport more delegates more quickly and deliver them directly to the conference hall door. Profitability is concerned with the bottom line – expenditure versus income – e.g. the cost by bus was less than the cost by train but fewer delegates attended the conference because many did not like bus transport.

Addressing the aspects in reverse order, the PPP is concerned with the lack of evidence that investment in IT hits the bottom line as profit. The efficiency of IT is the essence of the Information Productivity® theory. Cost effectiveness is covered by both the PPP and Information Productivity® literature – in the PPP, it is argued that any short term gain is traded away before it hits the bottom line (the Redistribution explanation) while the Information Productivity® theory sees cost effectiveness as being at the heart of, and the direct result of, making transactions more efficient.

A serious fault with the PPP debate is that it has been an almost exclusively economic rather than IT debate. It is doubtful that many IT professionals working in the field are even aware of the paradox. As anecdotal evidence, an informal poll at a recent meeting of a national computer society chapter found only one person among the 43 present had

ever even heard of the PPP – and that person was an academic. This lack of an IT focus to the research may explain another anomaly – the lack of practice-based implementation research. A sample of studies investigating the profitability/productivity of implemented IT systems is listed in Table 2-3. The paucity of implementation studies is especially curious in light of the extensive cost-benefit analysis documentation that is usually necessary to justify the purchase of IT infrastructure.

Table 2-3 Sample of PPP Implementation Studies

Authors	Study	Results
Alpar & Porembski 1996	Banking	Cost savings significant in 1989 but minimal by 1994
Oberlin 1996	Education	Supports PPP - there was no IT application the campus that could not be replaced by something less expensive and more effective
Mukhophyay, Rajiv & Kannan 1997	OCR and Bar Code technology in U.S. Postal System	Productivity increases in some but not all areas
Mukhop, Lerch & Mangal 1997	Turnpike Toll Collection	15% increase in tolls collected per hour
Cook 1999	Insurance	No significant improvements in productivity
Chakraborty & Kazarosian 2001	Trucking	Found firms used varying amounts of IT depending on their marketing objectives. A firm with an objective of 24 hour guaranteed delivery was able to show productivity improvements from IT where a firm whose objective was to be the lowest cost operator could not.
Peslak 2004-5	Education	Tested IT spending against student scores in 3,590 schools and found no positive relationship
Lapointe, Mignerat & Vedel 2011	Health Care	Three case studies with mixed results. PPP transposed to stakeholder theory where 'success' of systems depended on the expectations of the stakeholders.

Another criticism of the PPP debate may be made concerning the classification of IT investment. The cost of IT has dropped rapidly while the spending on IT has increased equally rapidly. A dollar invested in a 1970s mainframe does not equate to a 2000s dollar spent on a smart phone in capital terms but may be comparable in terms of transactional costs as per Strassmann.

When considering the relevance of the literature to the potential productivity and profitability associated with the implementation of multimedia technology, the prospects are particularly grim. Many sources maintain that multimedia is unlikely to initially, or ever, save the enterprise time or money (Quinn and Baily 1994; Burge 2000; Cassidy 2000; Fahy 2004), may in the short term cause chaos, promote time-wasting and lower productivity (Murgatroyd 1992; Laudon, Traver, and Laudon 1996; Fernandez 1997; Evans 1998; Fahy 2000; Dalal 2001; Fahy 2004), and the total cost of ownership will be many times the purchase price and will constantly rise with no genuine prospects of recouping costs (Oberlin 1996; Welsch 2002; Black and Lynch 1996). While these opinions concerned with the possible negative effects of multimedia are asserted, no specific evidence is presented.

The rationale for adopting multimedia is said to have been more related to issues of technical performance, flexibility, improved learning and user satisfaction than cost savings (Oberlin 1996; Fahy 1998; Fahy 2004). Strassmann's explanation for the PPP presented in Chapter 2.7.3.7 supports this view. No investigations have been located in the literature concerning the use of multimedia to improve productivity or profitability. In addition, Gurbaxani and Kraemer (2003) note that most of the previous firm level research involved data from large firms (as it is difficult to get data from smaller firms),

and suggest smaller firms are ripe for future research. This research is directly targeted towards gaining information at the firm level.

The Does IT Matter? debate continues and may become the defining IT/economic controversy of the next decade. However, multimedia as used in OHSE is not ‘just another commodity’ that can be obtained with little or no entry cost or effort. On that basis the Does IT Matter proposition doesn’t directly impact the focus of this study and will be left to future researchers to resolve.

Of the possible explanations of the PPP, redistribution - the trading away of productivity or profitability gains and/or the creation of organizational slack - has not been disproven and holds good prospects for IT based, qualitative investigation. Strassmann’s Information Productivity® proposition has not yet been subject to independent, case study verification.

In respect of the main research question Q0, we ask:

Q7.0 Does the adoption of multimedia OHSE inductions support or refute the PPP?

Sub-questions:

Q7.1 Have multimedia OHSE inductions been cost effective? How has this been determined?

Q7.2 Has multimedia affected the efficiency of inductions?

Q7.3 Were ‘profits’ traded away before hitting the bottom line?

2.9 POST ADOPTION: PARADIGM SHIFT

2.9.1 Paradigm Shift

As the main thrust of this research is the investigation of a paradigm shift, it is important to define the phenomena. In its simplest form, a paradigm shift occurs when the usual and accepted way of doing or thinking about something changes (*Compact Oxford English Dictionary of Current English, 3rd Ed. 2005*).

Kuhn (1962/1970) formalised a definition of paradigm shift as it applies to the evolution of scientific thought and theory. In Kuhn’s view, a monopoly is enjoyed by the currently reigning paradigm which is then completely superseded in a quantum leap by the new paradigm - there is no middle ground, no smooth transition from one pattern to the other, the change is rapid and unstructured. As an example, the paradigm that the Earth was flat was embraced by all respected scientists of the day. Adopting the notion that the world was round quickly and completely invalidated the previous mind set – the earth couldn’t be ‘sort of flat’ or ‘a bit round’.

While Kuhn’s original view of a paradigm shift concerned a change in a system of thought or beliefs, in contemporary use, a paradigm shift may also be a change in behaviour or practice. For example, the paradigm shift in the manufacture of cloth - prior to the industrial revolution it was manufactured in cottages, after the advent of steam power, it was made in factories. A check of 20 dictionaries available via

www.onelook.com (accessed 25th August 2010) finds no definition of paradigm shift that restricts the concept to change in thought or excludes changes in practice. The first 20 papers listed by relevance from a Proquest search (accessed 25th August 2010 to earliest possible date) with the keywords 'paradigm shift' and 'information technology' all concerned changes in practice (rather than thought) in organisations and segments within the IT industry.

2.9.2 Disruptive Technology

Disruptive technologies, also known as discontinuous innovations, have been identified by Anderson and Tushman (1990), Bower and Christensen (1995) and others as those innovations that bring revolution rather than evolution to the marketplace. They provide the basis for paradigm shifts and often provide 5-10 times improvement in performance and a 30-50% reduction in cost and or performance (Kassicieh et al. 2000).

The majority of the literature on disruptive technologies is focused on identifying and differentiating the corporate source of disruptive technology – new company versus established R & D department (Moore 1991; Kassicieh et al. 2000; Walsh, Kirchhoff, and Newbert 2002). Rather than joining the general debate on the source of innovation, in this research we are focused on a particular, emerging technology from a new company.

The literature and the financial pages are rich with anecdotal evidence of new, small firms using innovative technology to attack existing markets. This is generally seen as the classic disruptive technology, dot com, IPO scenario (Walsh, Kirchhoff, and

Newbert 2002). Bower and Christensen (1995) and Christensen (2007) did for disruptive technology what Kuhn (1962/1970) did for scientific paradigm shifts in establishing a structured definition. Christensen identifies two disruptive technology scenarios – the ‘low-end disruption’ or consumer market and the ‘new market disruption’.

In low end disruption, the consumer who has been disenfranchised from using a technology either by cost or access is targeted. A lower cost, lower performing alternative to the existing technology is offered. While the performance may be far below that of the incumbents, it far exceeds the target consumer’s requirements. An example of this is the Personal Computer (PC). Consumers denied access to mainframe and minicomputers were offered an affordable product that could compute far beyond their expectations. Eventually the capabilities of the desktop/server exceeded that of the incumbent corporate mainframes/minis and they became history. In new market disruption, an often costly technology is introduced to serve a new market segment. When first introduced, the petrol motor car was far more expensive than the horse and cart and appealed to only a small market segment.

As time passes, the disruptive influence of a new technology diminishes (Walsh, Kirchhoff, and Newbert 2002). What was once unique and the source of disruptive change (e.g. the automobile, the internet) becomes ordinary and ubiquitous.

Christensen and Raynor (2003) replaced the term *disruptive technology* with *disruptive innovation* to broaden the theory’s base. John C. Dvorak, long time and well known

columnist for *PC Magazine*, labelled Christensen's theory as '...the biggest crock of the new millennium' (Dvorak 2004, p. 1). Dvorak examines many of Christensen's examples of the low end, low cost consumer technology and finds that 'adequacy is sufficient'. The microcomputer did not replace the minicomputer - it was a more expensive replacement for the slide-rule and mechanical calculator. Have internet sales of books supplanted bookstores? Not likely, says Dvorak, when you look at the number of retail book stores. Linux, one of Christensen's major examples, has not replaced Microsoft operating systems. In 1992 when Linux entered the marketplace, Microsoft had \$US2.2 billion cash in the bank. In 2004, Microsoft had \$US70 billion. 'But the way these dingbat bromides go unchallenged makes you wonder whether anyone can think independently anymore.' (Dvorak 2004 p. 2).

Further criticism has been levelled against Christensen that he 'cherry-picked' examples to support his framework and that he ignored potential disruptive technologies that did not succeed - e.g. Iridium satellite phones (Danneels 2004). 'The real paradox is that a whole class of great firms did *not* fail despite often trailing the market in the introduction of disruptive technologies' (McKendrick, Doner, and Haggard 2000, p. 26).

2.9.3 Revolutionary Technology

In either a paradigm shift or adoption of disruptive technology, an element of revolutionary change is present. To make the change, a firm must be willing to scrap their old pattern of behavior in favour of the new. It is understandable that a certain amount of resistance is involved in such a change. Moore (1991) describes the process

of ‘crossing the chasm’ as identifying significant value, profit and performance propositions adequate to support the jump and overcome the newness of the innovation.

The marketing mechanism for overcoming this buyer resistance to change is to demonstrate the new technology provides enough benefit in the form of significant cost reductions and/or performance improvements (Von Hippel 1986). This concept in turn links back to Chapter 2.3 where marketing is discussed.

2.9.4 Critique and Relevance

The simple definition of paradigm shift – one pattern of OHSE inductions being displaced by another – is adopted for this research. While there are some similarities between Kuhn’s definition of a scientific paradigm shift and the paradigm shift explored in this research, Kuhn himself makes the point that he only developed the theory of scientific paradigm shifts to demonstrate to his colleagues in the social sciences that the strict definitions of physical science were not possible in their disciplines. While the present study may find some points of reference with Christensen’s classification of low and high end disruptive scenarios, multimedia OHSE inductions may be found to have attributes of both.

In relation to the main research question Q0, we ask:

Q8.0 Has the change to multimedia OHSE inductions been viewed as revolutionary? If so, what factors proved powerful enough to cause the firm to ‘take the leap’?

2.10 CONCLUSIONS AND PROPOSITIONS SUPPORTED BY THE LITERATURE

The overarching research question in this thesis is:

**Q0: What factors, forces and influences are driving the technological
paradigm shift from traditional OHSE inductions to multimedia?**

The literature in respect of this question – divided into four general segments and seven theoretical areas - was reviewed. In the following paragraphs a short summary of the propositions supported by the literature review in each segment is given and the relevant research in this thesis identified.

In the innovation segment of the literature, it was found that the majority of papers were concerned with the source of innovation rather than the technology push-market pull cycle. The literature supports the propositions that:

- As technology is pushed to a new market, the market will in turn pull technical applications (Moore 1991; Bower and Christensen 1995; Walsh, Kirchhoff, and Newbert 2002).
- Technology-Push will be the source of disruption with the disruption diminishing over time (Walsh, Kirchhoff, and Newbert 2002; Bower and Christensen 1995; Christensen 2007).

The research described in this thesis targets how Market-Pull influenced the modification of the multimedia technology originally pushed to prospective clients to

arrive at the final multimedia OHSE induction product currently enjoying commercial success.

In the marketing segment, the literature concerning the USP and Product Positioning marketing strategies was examined. The literature supports the propositions that:

- Assertions concerning the unique benefits and advantages of OHSE multimedia inductions (USP) will be strong incentives to adopt (Reeves 1961).
- Product Positioning of OHSE multimedia inductions against other products, trusted authorities, celebrities, or the 'herd' will provide strong incentives to adopt (Hoteling 1929; Ries and Trout 1986).

This research investigates how USP and Product Positioning may have influenced the adoption of multimedia for OHSE induction.

In the technology adoption literature, it was found that the TAM/TAM2 model has been successful in identifying a number of major factors in adoption. However, little research had been done on actual implementation and practice - needed to engender industry and education progress. The literature supports the proposition that the following TAM/TAM2 constructs will be important factors in the initial adoption, current practice and future implementation (Rogers 1962, 5th Ed. 2003; Moore 1991; Davis 1989; Davis, Bagozzi, and Warshaw 1989; Venkatesh and Davis 2000):

- Perceived Usefulness (PU)
- Perceived Ease of Use (PEOU)
- Demonstratability

- Job Relevance and Output Quality
- Image
- Subjective Norm - directly in mandatory situations and indirectly via PU (Hartwick and Barki 1994; Moore and Benbasat 1991; Venkatesh and Davis 2000)

This study targets the role of these factors and forces in the implementation, practice and intention for future adoption of multimedia OHSE inductions.

The literature concerning the adoption of a particular media based on MRT was reviewed. Based on the equivocality and uncertainty in a message, MRT predicts that face-to-face presentation is the richest media and the best method of dispelling equivocality (Daft and Lengel 1987; Webster and Trevino 1995; D'Ambra 1995; Webster, Trevino, and Stein 1996; Vickery et al. 2004; Caspi and Gorsky 2005). Adopters in this study have used multimedia to replace face-to-face training. This research examines the forces and factors involved in the choice of multimedia over face-to-face delivery of OHSE inductions.

The literature concerning the role of DOC legislation was reviewed and showed that aspects of both common law and legislative law may bring pressure on firms to increase their level of care and predicts that:

- Mandatory DOC legislation will be a strong factor in adoption (Cassidy 1995; Loosemore and Andonakis 2007)
- PU will not be affected by mandatory DOC legislation (Hartwick and Barki 1994; Venkatesh and Davis 2000).

This research examines DOC law as a factor in the adoption of OHSE multimedia inductions.

The literature concerning the PPP was reviewed and found to support some mixed findings:

- The PPP has not been dispelled
- Investment in multimedia will not be cost effective (Quinn and Baily 1994; Burge 2000; Cassidy 2000; Fahy 2004)
- Investment in multimedia may prove to be disruptive or counterproductive (Murgatroyd 1992; Laudon, Traver, and Laudon 1996; Fernandez 1997; Evans 1998; Fahy 2000; Dalal 2001; Fahy 2004)
- Investment in multimedia has no prospect of ever providing a ROI (Oberlin 1996; Welsch 2002; Black and Lynch 1996)
- Profitability of IT cannot be determined due to lack of reliable data (Brynjolfsson and Hitt 1993)
- Multimedia as a form of IT will improve the efficiency of inductions (Strassmann 2004d, 2001a, 2004b, 2004c) but will not improve profitability (Triplett 1999; Dedrick, Gurbaxani, and Kraemer 2003; Melville, Kraemer, and Gurbaxani 2004; Ahituv and Greenstein 2005; Byrd et al. 2006; Ross and Ernstberger 2006)
- 'Profits' from investment in IT may be traded away before they reach the bottom line (Brynjolfsson and Hitt 1993; Hayward, Magrassi, and Roberts 2002).

This research includes investigations of all these factors in a number of case studies of OHSE multimedia inductions.

The literature concerning paradigm shifts and disruptive technology in the post adoption segment was reviewed. The literature supports the propositions that:

- There must be a powerful incentives for enterprises to 'make the leap' (Von Hippel 1986; Moore 1991).
- The paradigm shift will be caused by the introduction of a disruptive technology (Anderson and Tushman 1990; Bower and Christensen 1995; Christensen 2007)
- The paradigm shift will be revolutionary, there will be no mixing of the old and new paradigms and the change will be sudden and unstructured (Kuhn 1962/1970)

If the adoption was viewed by the adopters as revolutionary, this research targets the usages and applications that were compelling enough to encourage the adopters to 'make the leap'.

In Chapter 3, we will discuss the methodologies used to research the theoretical propositions identified by the literature review as they relate to the research questions.

Chapter 3 METHODOLOGY

3.1 INTRODUCTION

This chapter describes the research methodologies adopted for the research in this thesis. It includes information on the author's perspective as a research resource, the scientific perspective of the research, the case study methodology chosen for the research, the source and choice of the case study units, the inclusion of exploratory and confirmatory case study units and the structure of the qualitative data analysis.

3.2 THE AUTHOR'S PERSPECTIVE

3.2.1 Author's Experience as a Research Resource

Prior knowledge gained through experience and socialisation undoubtedly influences a researcher's work. Further, this influence of a researcher's social history and knowledge should be acknowledged and encouraged rather than suppressed – 'Thus starting from scratch with an absolutely clean theoretical slate is neither practical nor preferred.' (Perry 1998, p. 787). In the spirit of this exhortation, the author brings his experience and knowledge to this work as a resource.

The author has 45 years of professional experience, on 4 continents, in most facets of the IT industry. He has been a member of the Australian Computer Society since 1971. A career in gas, oil and mining IT and System Control and Data Acquisition (SCADA) systems in Australia led, in 1979, to the establishment of a consultancy practice specialising in heavy haul (mining) railroad, asset protection systems (systems that

guard against collisions, derailments and/or damage to the rolling stock, track and permanent-way). As of 2008, 100% of the iron ore (and 50% of the coal) railed for export from Australia passes over systems developed by the author. In dealings with industrial clients, the author has participated as an inductee in over 100 OHSE inductions. In his work with multimedia inductions, he has designed, scripted or reviewed another 100 or more.

3.2.2 The Author's Relationship to the Case Study Units

As an outgrowth of his technical systems, the author's clients commissioned him to develop multimedia presentations for visitors, new employees and contractors that visualised and explained various railroad systems. This required the establishment of a multimedia design studio, equipment and staff. Impressed by the results obtained, the clients next requested corporate image presentations and conversion of their old, slide-show style OHSE inductions to multimedia. To accommodate this growing work, a separate design company, The Multimedia Company, was established in 1998 and has since expanded to become a premier, award winning supplier of multimedia OHSE inductions in Australia and the Middle East.

The Multimedia Company is an alias used in this thesis in place of the actual name of the multimedia design company. This has been done to avoid any hint of commercialism. While founded by the author, the author no longer has any direct financial interest in The Multimedia Company nor had he any direct contact with any of the adopters studied in this thesis prior to the actual research.

3.2.3 The Multimedia Company's Unique Resource

The Multimedia Company provides the opportunity to access a pool of multimedia OHSE adopters that would not otherwise be possible. Most major firms treat the internal workings of their OHSE departments with a high degree of confidentiality. The possibility of criticism by governments (local, state or federal), unions or the press for breaches (real or perceived) of OHSE requirements is a constant threat. Through a co-operative relationship with The Multimedia Company, the author has been allowed to directly access both the records of the company and its unique pool of adopters.

3.3 SCIENTIFIC PERSPECTIVE

Depending on the theoretical view taken, there are literally hundreds of classifications and sub-classifications of scientific research methodologies in the literature. It is not the intent or purpose of this work to detail, examine or describe them all. Rather the two basic lines of scientific perspective that are applicable to this research are defined, examined and described.

Ontology addresses ‘...theory about the nature of being or the kinds of things that have existence’ (*Merriam-Webster OnLine Dictionary*). Since there is nothing that does not exist, ontology addresses the characteristics of everything – that is it examines the nature of nature. As scientific research is an attempt to understand nature, it follows that ontology is science’s highest level of investigative structure. If science is to gain knowledge concerning nature, the question arises, ‘What kind of knowledge is acceptable?’. Epistemology is the study of knowledge that addresses ‘its validity,

methods, and scope.’ (*Merriam-Webster OnLine Dictionary*). Epistemology has historically divided the pursuit of knowledge (science) into two main schools of thought – objectivism and subjectivism (sometimes also called constructionism).

3.3.1 Objectivism and Positivism

In the framework of social research (under which umbrella this work falls), objectivism posits that ‘social phenomena and their meaning have an existence that is independent of social actors.’ (*The Collins Australian Pocket Dictionary of the English Language* 1991). The behavior of a rioting mob transcends the action of its individual members.

Objectivism has historically led to positivism as its scientific paradigm. Positivism is the framework that is generally known as the ‘scientific method’. Positivism emerged in the Age of Reason as a rebuttal of metaphysical thought and explanation of nature.

Auguste Comte (1798-1857) formalised positivist thought which placed an emphasis on systematic, empirical testing rather than speculation (Bryman 2001). Positivism holds that ‘all true knowledge is scientific, that all things are ultimately measurable’, and that ‘social processes are reducible to relationships between actions and individuals.’

(*Merriam-Webster OnLine Dictionary*). The key features of modern positivism require ‘true science’ to have a focus on statements, logical structure, testability, reproducibility, commensurability, and universal applicability - one universe, one science (*The Fontana Dictionary of Modern Thought* 1999). Positivism based research is inherently quantitative and deductive.

3.3.2 Subjectivism, Interpretivism and Realism

Subjectivism may be described as an epistilological position that requires social scientists to grasp the meaning of social actions (Jacob and Jakesova 2002). As opposed to the objectivists, subjectivists see social phenomena as being dependent on the social actors – in a mob riot, the motivation of the individuals determines the actions of the mob. There are a number of subdivisions of subjectivism including critical theory, constructivism and realism.

Subjectivists argue that the abstract laws and measurements of the positivists have no relationship to real people or social situations (Bryman 2001p. 504). Subjectivists see people in the context of their social situations, groups, cultures and experiences rather than as a reducible individual.

One of the lines of subjectivist thought leads naturally to the interpretivism paradigm. Interpretists base their research on data, but data that is acquired through recordings, observations or interviews rather than via direct measurement (what motivates a person to participate in a riot?). Interpretists do not attempt to reproduce findings, rather they aim to produce understanding that illuminates the reality of subjects being studied (Shanks, Rouse, and Arnott 1993). One line of interpretist thought leads to realism.

Positivism requires an observable source for research – if it can't be observed and measured, it cannot be investigated. Realism addresses itself to the investigation of the 'unobservable'. For example, while the effects, severity and impact of depression can be observed, no one has ever actually seen depression (Where is it located? What colour is

it?). Examples are not restricted to the social sciences - in the 'hard' sciences, no one has actually seen the inside of a black hole (or is ever likely to). Much of what is now known as quantum mechanics was developed using the realism paradigm.

If the data being investigated are unobservable, how can the research be accomplished? Realism holds that the entity being investigated exists independently of the investigation, that research over time improves the description of that reality, and that it is only the complexity of the subject and the shortcomings of the research that hinders complete understanding (Shanks, Rouse, and Arnott 1993).

Research done in the realism paradigm is qualitative and inductive but also subjective. Perry (1998) argues that this is the proper home for the case study method because i) the case study is concerned with reality, ii) the subject being studied is generally new and not fully understood (contains unobservable elements) and iii) with careful application, the results are commensurate. While realism has some positivism like characteristics, for the purposes of this research (and as the home of case study research), it is placed in the interpretivism camp.

Figure 3-1 illustrates the relationship of the elements in the scientific perspective of this work. The deductive-inductive hierarchies of research perspectives are shown top to bottom with the objective-subjective equivalent methodologies shown left to right. The employment in this research is indicated by the weight of the connecting lines.

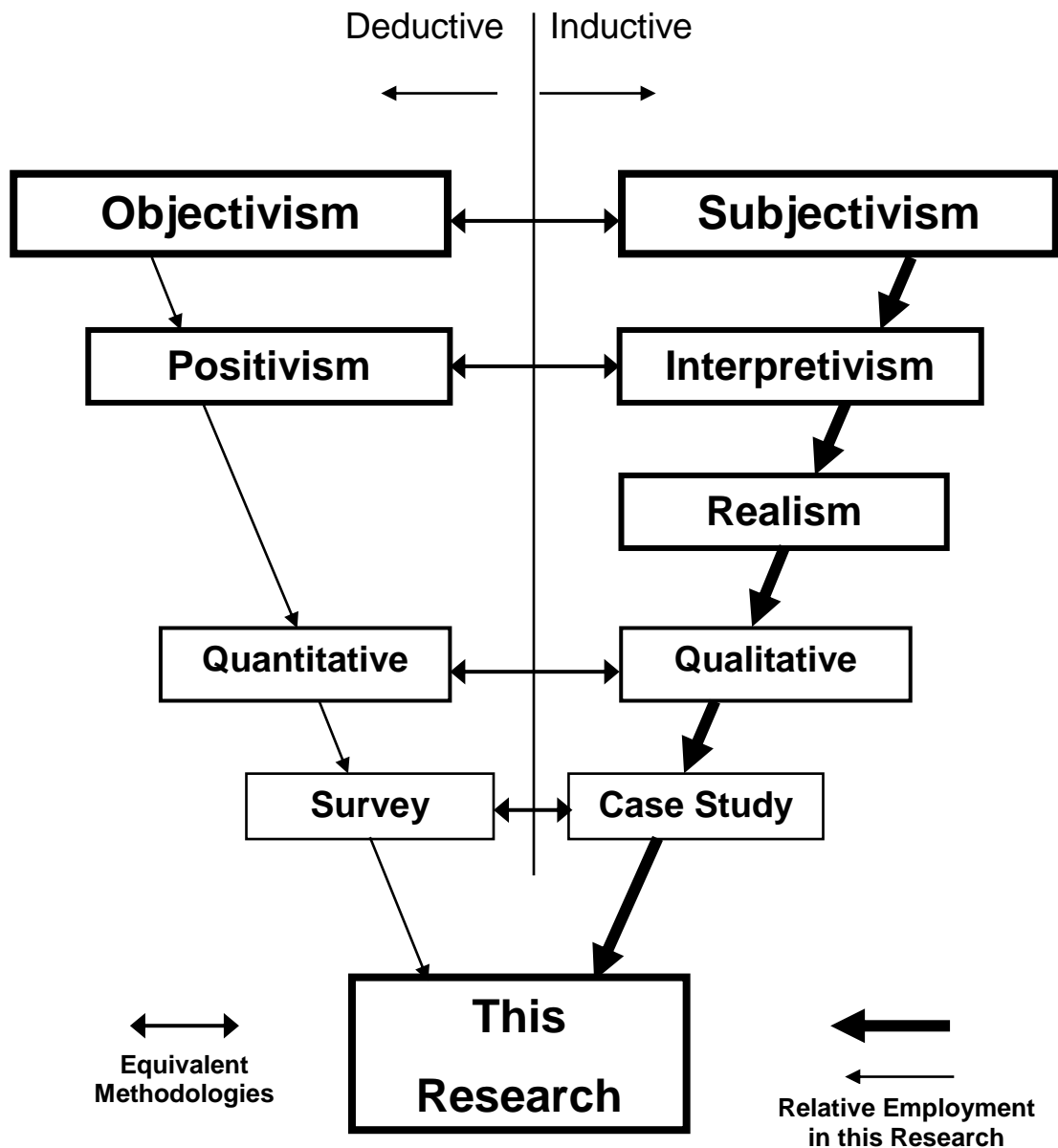


Figure 3-1 Scientific Perspective of This Research

3.4 THE CASE FOR CASE STUDY METHODOLOGY

The literature is rich with material written on the subject of research strategy and methodology. No single research methodology is suitable for all occasions – each has its own advantages and disadvantages (Gillham 2005; Grbich 2003; Palvia 2004; Avison et al. 1999; Shanks, Rouse, and Arnott 1993). Many sources highlight the growth of

qualitative methodologies – especially case study methodology (Pare 2004; Dube and Pare 2003).

Yin (2003b, 2003a) is the generally recognised champion and authority on the use of case study research. He summarises the appropriateness of the method as ‘...when investigators either desire or are forced by circumstances (a) to define research topics broadly and not narrowly, (b) to cover contextual and complex multivariate conditions and not just isolated variables, and (c) to rely on multiple and not singular sources of evidence.’ (Yin 2003a, p. xi). This research meets all three qualifications – scope, contextual focus and multiple sources – and therefore is eligible for the use of the case study method.

Another essence of the case study is that it attempts to illuminate a decision, why it was taken, how it was implemented and the result (Schramm 1971). This research is directly targeted towards the decision to adopt multimedia OHSE inductions, why it was taken, how it was implemented and what benefits resulted.

There are many stereotyped objections to case study research including opinions that it is weak, not objective, only anecdotal, not rigorous, descriptive at best and that it cannot be used to generalise. In response to these criticisms, Yin (2003b) asks the obvious question – if these objections are true, why do researchers increasingly use the methodology? He answers that the case study is the most applicable methodology in many instances and dedicates the remainder of his book to addressing these issues and setting out the rigour and disciplines required to execute a good case study.

The applicability of case study research to multimedia and OHSE adoption may be supported as follows. Chapter 2 reviewed the literature and identified the paucity of and need for additional case study research concerning the adoption of multimedia. In the Human Relations (HR) field, of which OHSE is a portion, the use of case study methodology is supported by Dul and Hak (2008). They searched the Proquest and the Institute for Scientific Information (ISI) databases of scholarly journals for the period 2000-2005 and identified 931 HR publications. Of these, 153, 24.4%, used case study methodology.

Walker, Lewis and Laskey (1996) sum up the case for the case study by noting that case studies intentionally provide more information than the researcher can understand or manage, the data is often fragmentary, unsystematic, ambiguous, unreliable, redundant, irrelevant or outright untrue. All these faults are in fact the features that make case study research attractive – ‘This is what we like about case studies, they are like real life’ (Walker, Lewis, and Laskey 1996, p. 36).

3.5 CRITERIA FOR THE USE OF CASE STUDY METHODOLOGY

Yin (2003a) identifies two categories of ‘what’ research questions – ‘what’ in the sense of identifying lines of further enquiry (e.g. ‘What can be learned from the cyclone Fred disaster?’), and ‘what’ in the sense of outcomes (‘What has been the effect of the section restructuring?’). Yin advises that when the question is of the second ‘what’ variety, that both the exploratory strategy (the goal being to test causes and propositions) and the descriptive strategy (the goal being to determine in what manner)

are applicable. The major ‘what’ research question in this research (What factors, forces and influences are driving the adoption of multimedia OHSE inductions in Australia?) meets both Yin’s requirements.

The ‘what’ type of question that forms the nucleus of this research can most efficiently be addressed by a case study. Implementation and practice is the predominant theme of the case study and Walker, Lewis and Laskey (1996), Bonoma (1983), Benbasat, Goldstein and Mead (1987) and Yin (2003b) generally agree that it is applicable where certain criteria as listed below are met. Each of these is discussed below with respect to the research.

3.5.1 Little is Known about the Subject

Benbasat, Goldstein and Mean (1987) describes case study methodology as being particularly applicable where research and theory are in their formative stages. In the case of this research, few papers concerning multimedia applications in general have been published during the past 10 years. For example, a Proquest search in September 2005 on the key words ‘applications’ and ‘multimedia’ listed no applicable paper more recent than 1992 (papers re e-learning and its variants were excluded). A similar search in March 2009 was rendered useless due to the tens of thousands of ‘hits’ thrown up by the continual use of the term multimedia for every telephone, mobile device and computer announcement or review. A search of the ACM Computing Surveys Archive in March 2009 found no applicable reviews relating to the key words ‘multimedia’ and ‘application’ more recent than 1995. Searches of other academic and thesis databases on these and related search criteria suggested by colleagues have yielded similar results.

No published empirical research has been located on the growth, implementation or practice of using multimedia in OHSE inductions. Other than speculation about the possibility of the phenomena, no research has been published containing details of productivity-profitability benefits being traded away to clients/user or redistributed within the enterprise. Little research in general, and no research regarding multimedia in particular has been published concerning actual usage rather than perceived usage of multimedia in a specific framework other than in e-learning and its variants.

3.5.2 The Subject is Idiographic

Idiographic research is used to study an individual unit(s) in its context as opposed to nomothetic research that seeks general laws drawn from broad groupings. Idiographic research has been suggested as being more suitable to IT (Bonoma 1983). Much existing TAM/TAM2 research is nomothetic (based on broad survey data). Much PPP research is also nomothetic (based on aggregate international, national, and industry based) data. This research is idiographic and directed towards individual adopters of multimedia OHSE inductions.

3.5.3 The Data is Captured from the Practitioners in their Natural Environment

The data in this research is captured directly from The Multimedia Company's clients in their offices and from multimedia OHSE inductions currently in use.

3.5.4 The Aim is Description of Practice and Determining what Adoption has Occurred

Yin (2003a) cites the investigation of ‘decisions’ as the major focus of case studies. The entire focus of this study is the identification of the factors, forces and influences affecting the decision to adopt. The aim of this research is specifically the understanding of what has occurred - adoption, implementation and practice.

3.5.5 The Paradigm is an Emerging Field and the Focus is on Contemporary Events and Context

Chapter 1.5.1 describes the contemporary emergence of the paradigm and the expanding use of multimedia in OHSE inductions. Multimedia OHSE inductions are a recent IT innovation with clearly identified organisational contexts which makes them a prime candidate for a case study: ‘Case study research is the most widely used qualitative research method in information systems research, and is well suited to understanding the interactions between IT related innovations and organisational contexts’ (Darke, Shanks, and Broadbent 1998, p 273).

3.6 THE CASE FOR PRACTICE-ORIENTED CASE STUDY

A theory is an attempt to explain a phenomenon. In the realm of human endeavours (as opposed to the physical sciences), the phenomenon being studied may be broadly termed behavior. Behavior in the execution of meaningful work may be termed practice. Therefore, theory by definition grows from practice. ‘Researchers usually learn by studying the innovations put in place by practitioners, rather than by providing the

initial wisdom for these novel ideas.’ (Benbasat, Goldstein, and Mead 1987, p. 370).

The ultimate recipient of the benefits of research is the practitioner. ‘If research does not have practical application, it has limited value in terms of advancing the work of a specialty’ (Salazar 2002).

Noordhof (1984) describes the on-going philosophical debate concerning the nature of the scientific method which pits the ‘methodologists’ against the school of ‘Wittgensteinian naturalism’. The methodologists assert that a methodology of science is describable independent of how science has actually been practised. The naturalists hold that an investigation of how science is actually practised demonstrates that it is certainly not a methodology - ‘Reason receives both its content and its authority from practice. It describes the way in which practice works and formulates its underlying principles.’ (Feyerabend 1978, p. 24). This is the position taken in this research - practice precedes theory.

What is practice-oriented research? To paraphrase Dul and Hak (2008, p. 49-50), practice-oriented research is defined as research that is aimed at contributing to the knowledge of practitioners and the business community is the primary user of the research.

What role does practice-oriented research have in theory-oriented/theory-testing research? Dul and Hak (2008, p. 49) urge ‘... an exploration of practice should be conducted first before a decision is made to conduct theory building research. The aim of this exploration of practice is the same as the aim of the exploration of theory, that is

to *find candidate propositions for testing* and, second, to *select one or more of these propositions for being tested in the study*'. The design of this research meets those aims.

In what circumstances can practice-oriented research be justified in academic work?

Bob Zmud, Editor-in-Chief, Management Information Systems Quarterly (MISQ)

provided these guidelines for the publishing of practice-oriented research:

'Practice-oriented articles obviously should be very accessible to the executive readership and should have an ultimate purpose of providing clear and compelling prescriptions or recommendations for practice. However, because the manuscripts are being considered for publication in *MIS Quarterly*, they should also reflect and contribute to the information systems knowledge of relevant prior literature; organize their 'story' around a conceptual frame that enables readers to better understand the key decisions, processes and forces associated with the phenomena being addressed; and objectively and accurately determine and report the benefits, concerns and limitations of the practices being examined' (Zmud 1997, p. 4).

The research in this thesis meets all these requirements – there is a full review of the literature against a conceptual theoretical frame, findings that include a description of the process, the reasons for decisions, the forces and factors involved and the benefits and limitations encountered.

How often is practice-oriented case study research employed? Yin (2003b) makes specific mention of practice-oriented research as being part of the extensive use of the case study methodology. Dul and Hak (2008, p. 23) found that of the 153 HR case study journal articles identified by their search as described in the previous section, 104 (68%) were practice-oriented.

3.7 THE CASE STUDY UNITS

3.7.1 The Case Study Units

The case study in this thesis contains elements of both a single and multiple-case design. The design is single-case in the sense that as discussed in Chapter 1.8, the study addresses the clients of a single company, and multi-case in respect of the multiple clients.

Is a study investigating the clients of a single company justified? Yes, if the company meets one of five requirements (Darke, Shanks, and Broadbent 1998, p. 273); the case is i) critical, ii) unique, iii) representative, iv) revelatory, or v) longitudinal. This research meets at least two of these criteria as discussed below. A single case study may be justified when the object of the study is rare or unique. As discussed in Chapter 3.2.3, The Multimedia Company is a rare and unique resource. As noted by Yin (2003b) and Drake, Shanks and Broadbent (1998), the availability of suitable case study participants may be restricted due to businesses not being willing to participate. This may especially be true in the case of OHSE as the target sites are sensitive to both legislative scrutiny and social pressures.

A single case study may also be justified when an observer has the opportunity to investigate a phenomenon inaccessible under normal circumstances. It is only through the author's experience and association with The Multimedia Company that access to the firm and its clients has been made possible. Perry (1998) notes that gaining an interview with even a single small business is difficult. Gaining access to an OHSE department is not unlike gaining access to celebrities or a militant political cell – it's who you know. This was confirmed many times over in the course of the case study interviews.

In Yin's terminology (1998), the multiple objects of study in this research (the clients of The Multimedia Company) would be termed the 'embedded units'. As the vast majority of the data presented in this thesis relates to the clients of The Multimedia Company, the embedded units will hereafter be referred to simply as the case study units.

3.7.2 Selection Criteria

Yin (2003b) makes the distinction that 'replication logic' rather than 'sampling logic' is used in case study research. Replication logic may be compared to multiple experiments. In each experiment, the researcher is attempting to confirm or reject a proposition. In sampling logic, the researcher is making multiple attempts to determine a better representative value of a variable. Sampling logic is not applicable to case study research nor is its premise of 'the bigger the sample size the better'.

Representativeness is also not an appropriate criteria for the selection of case study units (Herson and Barlow 1976). 'Random selection of cases is neither necessary, nor even

preferable.’ (Stake 1994, p.37). In replication logic, study units should be selected for the purpose of either confirming or rejecting the theory. Those units selected for the purpose of demonstrating contrasting results (for perhaps known reasons) are called theoretical replications. Those units selected for the purpose of demonstrating similar results are called literal or confirmatory replications (Eisenhardt 1989).

On what basis should the case study units be selected? Many criteria are suggested.

Patton (1998) suggests 15 sampling strategies paraphrased as: (1) Extreme cases, (2) information rich cases, (3) cases demonstrating maximum variation, (4) homogeneous cases, (5) typical cases, (6) stratified cases, (7) critical cases, (8) chaining (one-leads-to-another) cases, (9) cases that meet a set of criteria, (10) theory manifestation cases, (11) confirmatory cases, (12) opportunistic cases, (13) random cases, (14) politically important cases, (15) convenience cases. Patton’s theory manifestation and confirmatory cases align with Perry’s call for theoretical and confirmatory replication.

In this research, information rich cases (Patton’s 2) form the backbone of the case units. These units have the most experience with OHSE inductions in general and multimedia OHSE inductions in particular. Cases from different industries (Patton’s 10) have been selected to provide theoretical contrast. Within an industry, the cases have been selected by sector (Patton’s 6), as typical cases within that sector (Patton’s 5) with comparable enterprise attributes (Patton’s 9). Multiple cases within the sectors have been included for confirmatory purposes (Patton’s 11).

3.7.3 Elite Access Opportunity

Opportunistic sampling (Patton's 12) is predicated on the discovery of new units *after* commencing the initial work. A variation of *opportunistic* selection occurs when the availability of case units is determined by barriers of entry and issues of access. Such barriers exist when accessibility to the case units is limited by membership, secrecy, privacy, or privilege issues. Examples of such case units would include professional elites (for example doctors, lawyers, judges), business elites, celebrities, closed societies (for example Masons, Opus Dei), criminals (for example prisons, courts), terrorists or political activists, the very rich, religious groups, medical/mental patients, etc. In their study of corporate ethics, Yeager and Kram (1995) report being refused access by 36 companies before gaining access through a 'contact'. Access was eventually arranged only after the researchers were vouched for by a 'well-placed' executive. Other researchers report similar 'insider/outside' situations; when studying Hollywood elites, Gamson (2005) was often asked 'Who did you say gave you my name?' This theme is continued in other research such as Ostrander's (2005) study of private charitable foundations funded and administered by the ultra-rich. She had to be 'checked-out' and then referred by an insider. Ostrander makes the point that the gaining of entry is itself a valuable source of research narrative.

'Business elites have been traditionally the most difficult settings to gain access by social scientists. The hierarchies of business organizations are designed to protect those who work there and to deter outsiders from learning more about how they operate.' (Gillham 2005, p x). Through contacts in the industry, the author had the opportunity to gain access to the business elites interviewed in this study. These contacts would not have been available to an 'outsider'. This privileged access was confirmed many times

during the interview process. In this sense, the selection of case study units is ‘opportunistic’ but limited by ‘accessibility’.

3.7.4 Number of Case Study Units

While selecting case units on the basis of convenience, saving money, time or effort (Patton’s 15) may be the weakest reason for case selection (Patton 1998), in this case study travel logistics do impose some significant convenience restraints. To increase the number of interviews purely to ‘get the numbers up’ would have imposed an unviable level of financial, travel and time burden on the work.

Perry (1998), in his review of the issue of number of samples, cites Patton’s 15 strategies and suggests the selection of *information rich* cases. ‘This issue of information richness is fundamental to deciding on the number of cases.’ (Perry 1998, p 793). How many case study units should be included in a case study? Table 3-1 summarises the opinions gathered by Perry (1998, p.793). Perry assumes multiple interviews within each case unit. At the PhD level, he recommends 35-50 interviews originating from three hierarchical levels within 15 case study units. Perry mitigates this stance with the observation that obtaining even one interview in a small business or in any Asian organisation can be difficult. Where the number of interviews may be limited, he advises that additional interviews with industry associations, government offices or institutions in the research context or that increasing the scope of the literature review to be able to provide information- rich, probing questions may suffice. Perry suggests that students should use these numbers as a starting point and then possibly use the following quotation from Patton to justify not slavishly following the rule:

‘The validity, meaningfulness and insights generated from qualitative inquiry have more to do with the information-richness of the cases selected and the observational/analytical capabilities of the researcher than with the sample size.’
(Patton 1998, p 185)

Table 3-1 Recommended Number of Case Units

Author	Recommended Number of Case Units
Romano (1989)	The literature provides no guide, the decision is left to the researcher
Lincoln & Gubba (1985, p. 204)	Cases should be added ‘to the point of redundancy’
Patton (1998)	There are no rules
Eisenhardt (1989)	Cases should be added until theoretical saturation is reached 4-10 cases often works well
Hedges (1985)	4-6 groups is the reasonable minimum for a serious project Upper limit of 12
Miles & Huberman (1994)	Upper limit of 15
Perry (1998)	Upper limit of 15

Considering the quality of the case units, their information-richness, the accessibility factors, the marginal cost of adding additional units, the depth of the literature review and the breath of the theoretical scope, the 21 firms (17 with interviews) that form the main portion of the research are considered to be more than adequate.

The case study participants were selected on the basis of sector, industry, comparative size and accessibility. Where possible, the case study units were further selected to

represent indicative, comparative and investigatory samples – the information-rich cases. Case study participants were located in Queensland, New South Wales, Victoria, South Australia, and Western Australia. Exact pairing of case study units within sector and industry would have been the ideal. In practice, accessibility was the limiting factor.

The case study units are listed and described in Table 3-2. The multimedia OHSE inductions for Mining[3], Airport[2], Haulage[2] and Utility[2] were evaluated but no interviews were conducted. The Seaport[3] interview was conducted by telephone and is the only interview not conducted in the unit's premises.

Having identified and discussed the number and type of case study units employed in this research, for the remainder of this thesis, the term 'units' will be replaced by the more appropriate term 'participants'. The term participants will also be used to include both the enterprises and the individual respondents and interviewees.

3.8 RESEARCH DESIGN

3.8.1 General Design

The general theory on which this research is based was reviewed and the research questions developed in Chapter 2. Pilot case study participants were selected. The interview protocol was developed and trialed on the pilot case study participants. An evaluation of pilot case study participants' practice-oriented OHSE inductions and data was carried out. It was not found necessary to conduct further rounds of pilot interviews or evaluations.

The participants of the research were selected as described in Chapter 3.7.4 and the interviews and practice-oriented evaluations were carried out. The research material gathered was evaluated, the results were written up and reviewed.

Table 3-2 Case Study Participants

Primary Industry	
Mining[1]	International, multi-billion dollar mining company with multiple sites
Mining[2]	Billion dollar Australian mining company with multiple mine sites
Mining[3]	International, multi-billion dollar mining company with multiple sites
Agriculture[1]	Billion dollar crop transport, storage and sales firm with large numbers of seasonal workers
Agriculture[2]	Billion dollar crop transport, storage and sales firm with large numbers of seasonal workers
Manufacturing	
Construction[1]	International billion dollar construction company with multiple sites
Construction[2]	One of the largest commercial/industrial builder in Australia
HeavyIndustry[1]	Integrated mining, production and manufacturing enterprise
HeavyIndustry[2]	Integrated mining, production and manufacturing enterprise
DiverseGoods[1]	International billion dollar manufacturer and supplier of branded goods
Transportation	
Airport[1]	State capital international airport
Airport[2]	State capital international airport
Seaport[1]	State capital port
Seaport[2]	Multi-commodity port
Seaport[3]	Multi-commodity port
Haulage[1]	National specialty transport firm
Haulage[2]	National furniture and removalists firm
Services	
Services[1]	Branch of an international, billion dollar service group
Services[2]	Services provider off-shore oil/gas production and exploration
Utility[1]	State Water Authority
Utility[2]	Steam and power generation utility

Figure 3-2 summarises the stages of the research design. Further details of the research steps and issues are contained in the following sections.

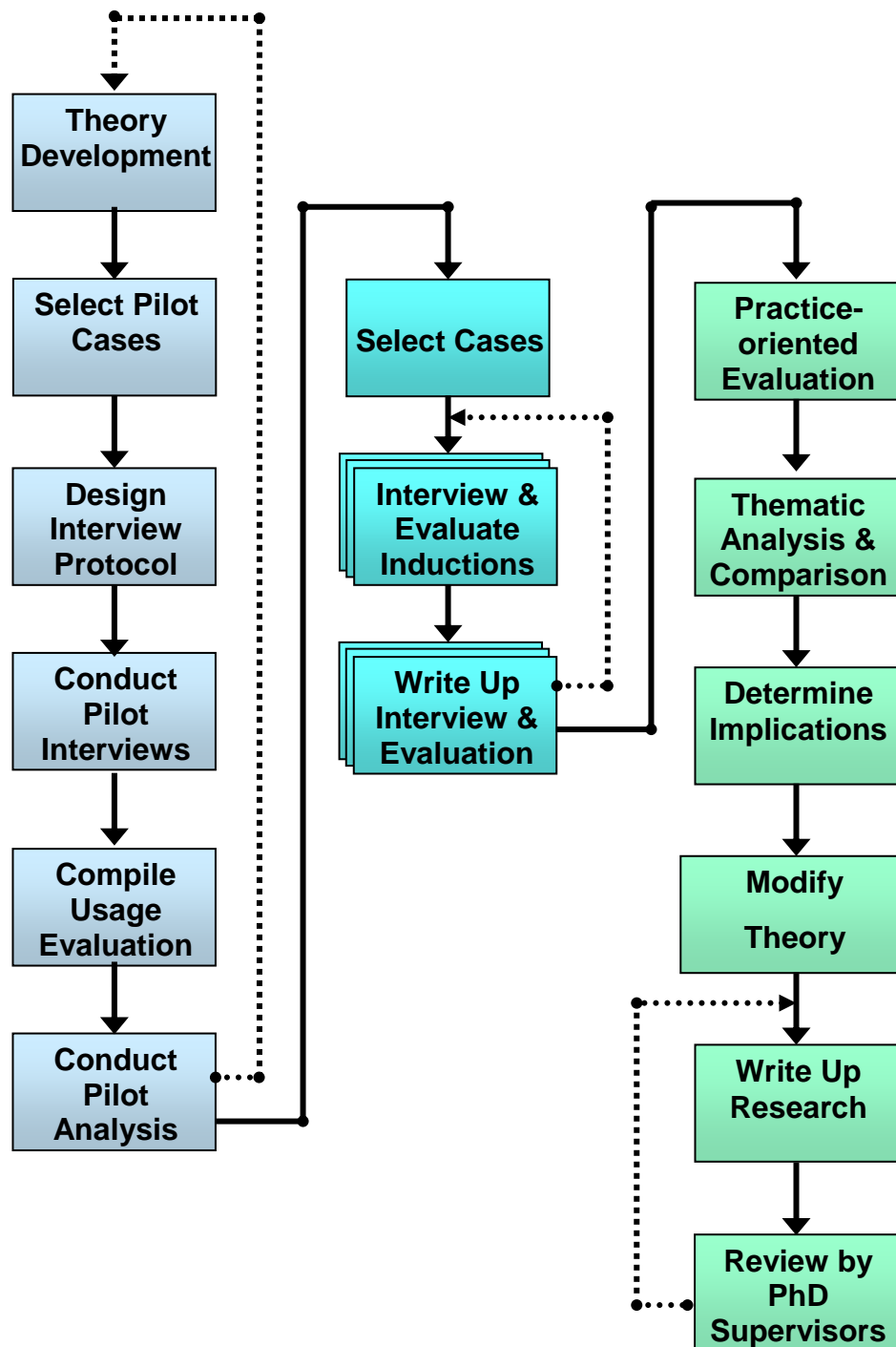


Figure 3-2 Case Study Design

3.8.2 3D Theoretical Replication

In formulating the research design, the course suggested by Perry (1998, p545) was followed. The design incorporates a three dimensional theoretical replication with both confirmatory and exploratory cases. The industry sectors (Primary Industry, etc.) represent the explanatory replications while the number of participants within each sector represent the confirmatory replications (Mining[1], etc.). This replication allows within sector attributes and between sector attributes to be examined.

Having selected case study methodology and the case study participants, the main body of the research data was obtained from two sources - the participant's multimedia OHSE induction(s) and an interview with the participants' responsible OHSE professional.

3.8.3 Sources of Data

In addition to the inductions and interviews discussed above, in investigating the innovation and marketing aspects of the study, various records of The Multimedia Company were consulted including correspondence, marketing text and graphics, multimedia presentations, web site history, and sales demonstration journals. Interviews were conducted with marketing and design staff where necessary.

3.8.4 Issues of Validity

Validity is a well agreed upon concept in quantitative research but may be a contentious issue in qualitative research. The post-modern rejection of the whole concept of a single

validity in favour of multiple validities can put the entire subject in turmoil. For example, Grbich (2003) touches on simulacra validity (copies without originals), neo-pragmatic validity (validity through paradox), rhizomatic validity (validities within hierarchies) and voluptuous/situated validity (male versus female validity).

In this research, the post-modern view of research is not employed and the more classical aspects of validity are adopted. Even so, the gulf between quantitative and qualitative validity can still remain an issue. As regards issues within case study methodology, Yin (2003) as usual leads the way. He identifies three validity criteria for case study research – construct, internal and external validity.

Construct validity requires firstly that the construct being studied is properly identified and framed, and secondly that the data collected is appropriate. The constructs used in this thesis were carefully defined and framed in Chapter 2 Literature Review. To satisfy the second requirement, Yin recommends the use of multiple sources of evidence, chains of evidence and review of drafts by key informants. Of these, this study employs multiple sources of evidence – multiple sources of records and documents for The Multimedia Company related issues, the OHSE inductions and interviews with the multiple participants. The use of key informants to review the draft report has been included in the research design.

Internal validity is concerned with the proper association of cause and effect where rival factors must be identified and/or eliminated. Yin recommends pattern matching, explanation building, rival explanations and logic models. The current study is very

much in this mould – we are attempting to determine various aspects of the adoption cycle. Each aspect and theory being investigated provides a rival and/or complementary explanation. Additional explanations are sought during the case study interviews. Thematic pattern matching is used in the thematic analysis of the interviews.

External validity addresses the study's applicability beyond its units of study.

Replication of the case units and pairing of investigatory and confirmatory units go a long way to satisfying this requirement. While no single study can be extended without concern, there must be a starting study (such as this one) with which to compare.

Reliability is also a validity issue. The research design included a pilot interview phase to iron out any problems with the interview process and to provide a stable interview platform. Interviews were recorded to allow for re-evaluation should new evaluation techniques be required.

Rogers (1962, 5th Ed. 2003) in particular identified communications channels as an important aspect of technology diffusion – and therefore a validity issue in research. He classified the channels into two categories – mass media and interpersonal contact. The degree of interpersonal social contact varied between early and late adopters. Being a case study of an almost single communication channel of diffusion (personal contact), this aspect of the adoption of innovation is not addressed in this thesis.

In considering validity in terms of data ‘quality’, it is worthwhile noting that the data was collected from experts in the OHSE field who are working in major enterprises across a wide range of business domains.

3.8.5 Issues of Ethics

The ethical requirements and procedures of Murdoch University were adhered to at all times. These consisted of Murdoch Human Research Ethics Committee prior approval of the research, informed consent of the case study units, and confidential handling of sensitive data as previously described.

3.8.6 Pilot Studies

As shown in Figure 3-2, the research was conducted using pilot studies. Pilot interviews and usage evaluation of the inductions for two case study units were carried out (these two interviews were included in the final results). The pilot study results were analysed and the research methodology was modified. The major change to the methodology after the pilot interviews was the deletion of a Likert scale prompt sheet. In the pilot interviews, a prompting sheet with various suggested descriptions for the 5 Likert scale levels was introduced. It was found that interviewees spontaneously used words such as excellent, very good, awful etc. to describe various aspects of OHSE inductions without the need for prompting. Upon completion of the pilot studies, the main body of the research (interview and evaluation of inductions) was carried out for each case study unit.

3.9 INDUCTION DESCRIPTIVE ANALYSIS PROCEDURE

During the interviews, the case study participants were asked to describe how their inductions were conducted (single person, in groups, etc.), to whom the inductions were given (staff, visitors, contractors, etc.) and how the inductions were presented (CD, DVD, on-line, etc.). Each multimedia induction was viewed by the author, the subject matter of each chapter or section was noted, and a list of multimedia techniques employed was compiled. In some cases where an interview with the case study participant was not available, an analysis of the subject's induction was included to provide a comparison with the subject's peers and across industry segments. The results of this descriptive, practice-oriented analysis are presented in Chapter 4.

3.10 INTERVIEW PROCEDURE

Prior to conducting the interview, a package of materials was sent to the case study participant. This package included a formal letter (on university letterhead) describing the aims and anticipated benefits of the research and an invitation to participate. The packet also contained a personalised introductory letter from the researcher including a short resume, a list of sample questions and a consent form outlining how the data would be handled and how anonymity would be maintained. Copies of these documents are contained in Appendix C.

If acceptance was received, a first person, elite interview with open ended questions was scheduled and conducted. Areas of discussion included previous training-presentation methods, marketing propositions and their relevance, Product Positioning and its relevance, usage, physical constraints of training methods, justifications for expenditure

on multimedia, equivocality as a factor in choice of media, DOC and other legislative requirements, productivity-profitability examples and anecdotes of multimedia use (if any), any practice of trading away or redistribution of productivity-profitability gains, revolutionary changes, identification of additional, rival forces, factors and influences in the adoption of multimedia. Sample questions are listed in Table 3-3.

The interview was commenced with a description of how the researcher came to be involved with multimedia and the present research. The interviewee was then invited to complete the consent form which detailed how confidentiality was to be maintained.

With one exception, the interviews were conducted in the case study participant's office. The interviews were recorded on a webcam with echo cancelling microphone and on a small, digital recorder. During the preliminary set up, the case study participants were made aware of the recording equipment and were directed to the consent form as a reminder of how confidentiality was to be maintained.

The interview was commenced with a description of how the researcher came to be involved with multimedia and the present research. The researcher then invited the case study participant to begin with a phrase similar to 'How did your company get involved with multimedia for OHSE inductions?' Without exception, the participants enthusiastically launched into 'their story'. The unstructured, but guided, interview was continued until the case study participants had covered all the main topics covered in the sample questions (Table 3-3). Additional discussion and comment was encouraged. The interviews generally took from 35 to 45 minutes.

Table 3-3 Sample Interview Questions

Sample Interview Questions	
1.	What multimedia marketing propositions did you find convincing?
2.	How do you see multimedia positioned against other methodology?
3.	What OHSE induction methodology was used prior to multimedia? Positive/Negative attributes?
4.	How is multimedia used in the induction process:
4.1	In groups? Individuals?
4.2	On-line? In the company's premises? Outside premises?
4.3	Who is inducted? (Staff? Contractors? Visitors?)
4.4	Who administers/supervises the inductions?
5.	How easy is it to use multimedia?
6.	Why has multimedia replaced face-to-face training?
7.	Has multimedia provided any improvements in Production? Profitability? Has multimedia been cost effective?
8.	As a result of using multimedia have:
8.1	OHSE Budgets been reduced? Avoided being expanded?
8.2	Department restructuring or personnel reassignment occurred?
8.3	Any non-financial benefits been realised?
8.4	Can any improvements be seen in the 'bottom line'?
9.	Has multimedia provided any problems or had negative results?
10.	Has the change-over been evolutionary or revolutionary? What perceived benefits induced the company to change?
11.	Are there any plans to expand the use of multimedia for other uses?
12.	Has use of multimedia been of assistance with Quality Management or ISO accreditation?
13.	Have there been any problems with scripting?

3.10.1 Elite Interview Challenges

As discussed in Chapter 3.7.3, elites pose particular problems of access. Once access is gained, a second set of challenges arises concerning the conduct of the interview.

Business elites have a well-developed distrust of outsiders and academics in particular (Grbich 2003), the interviewer walks a fine line between asking probing questions and having the interview terminated (Seidman 2006), interview time is generally restricted (Grbich 2003), the participants may know more about the subject than the interviewer

(Gillham 2005), the participants will often have their own agenda (Gillham 2005), the participants will often demand some level of control over use of the information gained (Gillham 2005), the participant may attempt to protect themselves and their organizations from outside scrutiny (Gillham 2005) and the interviews are almost always conducted in the participants' office posing problems of geography and cost (Seidman 2006). Each of these challenges and the strategy used to address them is summarized in Table 3-4.

3.11 TRANSCRIPTION, DECOMPOSITION AND ANALYSIS OF THE INTERVIEWS

There are no simple guidelines for the analysis of qualitative data – each study is different and the researcher must judge what variations are the most appropriate to their particular problem (Weber 1990; Elo and Helvi 2007). However, the common goal of decomposition, coding and analysis of qualitative data as described in the many publications on the subject is the reduction of the often voluminous data into a reportable summary from which conclusions may be drawn. The general aim of this process is illustrated by Figure 3-3.

Table 3-4 Elite Interview Challenges

Interview Challenge	How Addressed
Business elites have a well-developed distrust of academic researchers (Grbich 2003)	In the advance materials mailed to the interviewee and at the commencement of the interview, the author emphasised his industrial rather than academic background
The interviewer often walks a fine line asking relevant questions when such questions may lead to the termination of the interview (Seidman 2006)	From prior dealings with these professionals, the author was well aware prior to the interviews where this dividing line may lay
Any elite interview is generally limited to 20-30 minutes and is often interrupted by other 'urgent' matters (Grbich 2003)	The interview was structured to be able to be completed in 35-45 minutes
They may know more about the subject than the interviewer (and may be better placed to determine the relevant questions) (Gillham 2005)	Using an open structured interview, ample opportunity was afforded for divergent lines of discussion
They will have their own mental structuring of the subject material and will not tamely submit to a direct series of questions (Gillham 2005)	While ensuring that certain questions were addressed, the interviewee was encouraged to direct the discussion. For example, after introducing the subject and research, the author's first question was 'That's my story of how I got involved with multimedia OHSE inductions - so what's [company name]'s story?'
They will expect to exercise some control over what the interviewer does with the information (Gillham 2005)	In the consent form (see Appendix C) signed by the parties, the author undertook to maintain anonymity by deleting any reference or relationship between the data, interviewee and the company after transcription of the interview and follow-up questions.
They will have every reason to protect themselves and their organisation from outside scrutiny (Gillham 2005)	There was a surprising openness on the part of the participants even in relation to workplace injuries and deaths.
Interviews are almost always conducted in the interviewee's office (Seidman 2006)	Adequate travel time and cost were factored into the research process

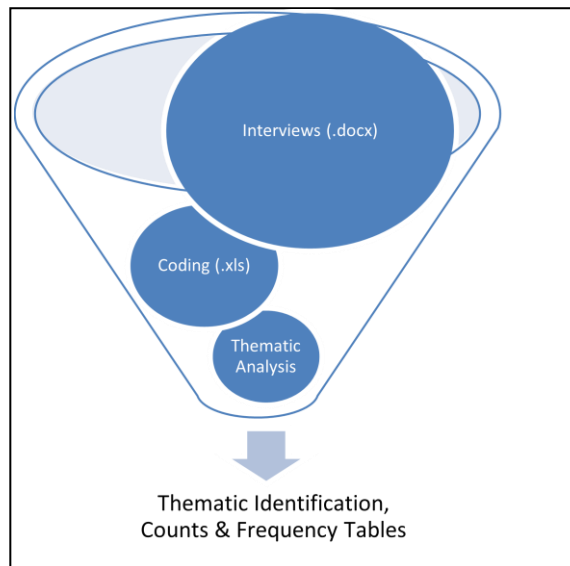


Figure 3-3 Reduction of Data

The methodology employed in this research is based on the procedures and protocols described by Mayring (2000) Thomas (2003) and Hsieh and Shannon (2005) and supplemented by advice from Hoepfl (1997), Miles and Huberman (1994) and Elo and Helvi (2007). Mayring's 'deductive' analysis procedure is shown in Figure 3-4. Figure 3-5 illustrates Mayring's procedure expanded to encompass the data flow as implemented in this thesis. The basic steps involved in the process are i) determination and definition of coding categories, ii) condensation of the data by coding, and iii) thematic analysis by identification and counting of themes. This is followed by an 'axial analysis' along rows/columns to identify any within/between trends, grouping and clusters as suggested by Miles and Huberman (1994, Chaps. 9 & 10). The raw interview data was transcribed, decomposed, coded and analysed as described in the following sections.

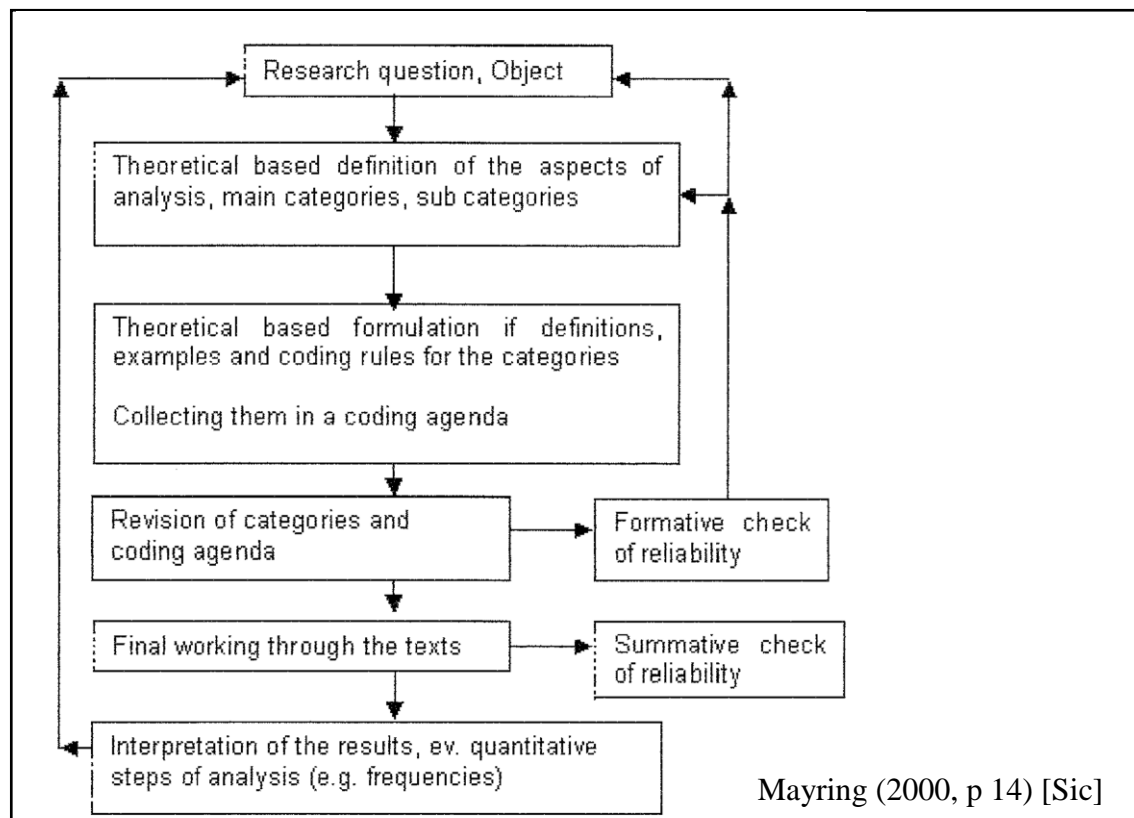


Figure 3-4 Mayring's Decomposition Protocol

3.11.1 Transcription of Interviews

The recordings were transferred to computer disk and backup CD-ROM. A number of approaches to transcribing the recording were attempted. In the first instance, an attempt was made to listen to portions of the recordings using an MP3 player and then type thematic notes. This was found to not only provide inadequate detail but meant that word/phrase searches other than those contained in the thematic notes could not be carried out. Transcription was next attempted using Dragon voice-to-text software (www.nuance.com). The voice-to-text software was first extensively trained to the researcher's voice. The researcher then used an MP3 player to listen to the recording on head phones and repeated what was said into a microphone. Despite extensive voice training, far too much time was spent using the MP3 player to go back to correct transcription errors.

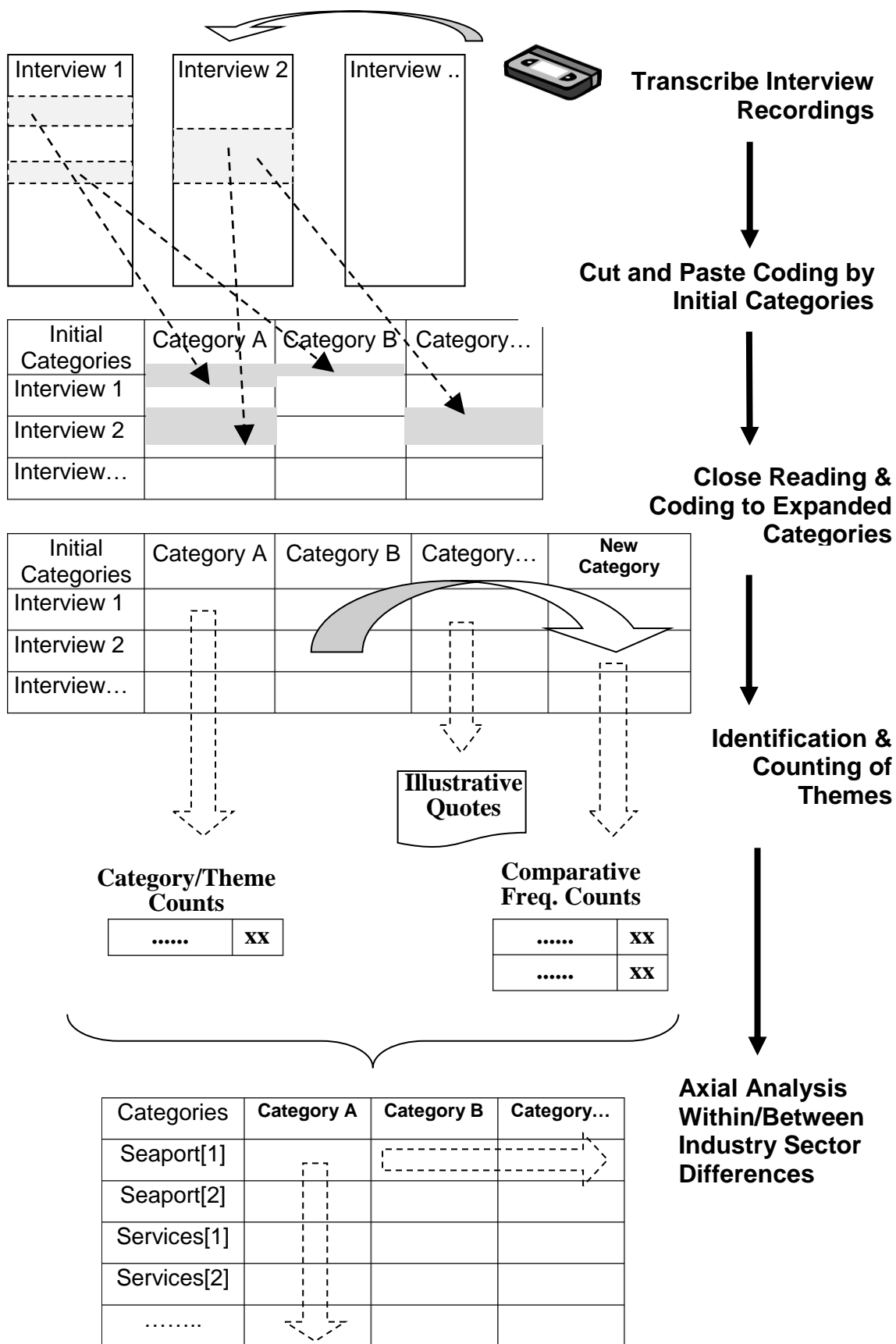


Figure 3-5 Content Decomposition, Coding & Reporting

The use of a specialised, free transcription playback program (ExpressScribe) was more successful. ExpressScribe provides many useful features for playing a recording while typing. These include the step back function which can be set to back up a configurable number of seconds in the recording and repeat, variable speed playback, variable pitch control and noise reduction. The final step in the solution was the addition of a three pad foot pedal that could be used to fast forward a few seconds, play/pause, and rewind a few seconds and replay. Approximately half the transcriptions were done by the author and half by an outside agency. The quality of the transcriptions done by the outside agency was quite variable. It was noticeable when transcribers who did not have English as their first language were used. Transcription errors were reduced when the service was provided with a list of unusual words, terms and phrases.

3.11.2 Initial Coding

Hsieh and Shannon (2005) reviewed the literature on qualitative content analysis coding and summarised and identified the main approaches to it as ‘conventional’, ‘summative’ and ‘directed’. The specific type of content analysis chosen varies with the focus of the study and the problem being addressed (Weber 1990). In all three of these qualitative content analysis methods, ‘coding’ is used to identify and assign content phrases to categories. Conventional coding is usually associated with phenomenology and grounded research where development of theory is the principal aim. Summative coding is associated with language usage and content with the purpose of understanding words in context (e.g. dying and hospitals). Directed coding, also known as deductive coding (Mayring 2000; Thomas 2003), is employed where ‘existing theory or prior research exists about a phenomenon that is incomplete or would benefit from further description.

The goal of a directed approach to content analysis is to validate or extend conceptually a theoretical framework or theory.’ (Hsieh and Shannon 2005, p 1281). In respect of the research goals of this thesis as set out in Chapter 1, directed content analysis has been chosen as the most suitable content decomposition methodology because this research builds on existing theory.

In directed analysis, the categories for coding are initially predetermined by the key concepts or variables of the theories being studied - the main purpose being to develop evidence of support or non-support of the theories investigated in the research. Content that does not fall under one of the predetermined categories may develop into a new category that further refines, extends or enriches the theories being studied. Both Mayring (2000) and Thomas (2003) emphasise the requirement to present the reader with the definition of each category (code), guidelines for coding that category and an example of each category/coding. This requirement is met in Table 3-5 which lists the coding categories and definitions, coding examples and coding guidelines and comments.

Due to the relatively small number of predetermined coding categories, sophisticated coding software such as NVivo was not employed. As discussed in Chapter 2.4.10, the pre-adoption belief constructs influencing PU are investigated while the pre-adoption PU construct is not (usage being addressed in the post-adoption domain and reported in Chapter 4). The pre-adoption variables are therefore assigned initial coding categories while PU itself is not.

Table 3-5 Initial Coding Categories

Category	Definition	Example	Coding Guidelines and Comments
USP & Product Positioning	Incentives to adopt based on marketing propositions	'The key critical thing that attracted me was the ability to update.' Agriculture[1]	'We just saw it & wanted it.' should be coded as demonstratability
Demonstratability	Incentive to adopt based on observable benefits	'When we saw it we could see the enormous advantage of it.' Agriculture[2]	Includes benefits seen in other or related industries
Job Relevance & Output Quality	Incentive to adopt based on applicability to client's enterprise & quality of the induction	'I've been very impressed with the quality and the understandings of [the company], that has been the main thing.' Mining[1]	If based on work in other industries then should be coded to Demonstratability. Quality of product not quality systems
Subjective Norm & Image	Factors relating to enterprise image and industry standard	'We certainly wanted to be seen as progressive sort of leading company in that area.' Construction[2]	Includes wanting to be industry leaders & at the 'cutting edge'
PEOU	Factors relating to ease of use (in practice)	'Inductees find it, they find it very easy to use.' Airport[1]	Includes any usage problems as well
Uncertainty, Equivocality & Consistency	Reasons for going away from face-to-face inductions. Factors relating to consistency & reduction of uncertainty	'I think really the consistency is one of the key advantages there.' HeavyIndustry[1]	Includes content, delivery & time consistencies
DOC Legislation	Forces for adoption due to legal requirements. Use of inductions & records in safety investigations	'And it was actually a solution to an issue caused by the Australian Bill of Construction Issue Commission.' Construction[1] 'Yes, it is our intention [to use it if there's any work safe investigation] Diverse Goods [1]	Include general concerns re providing duty of care to employees

Table 3-6 Initial Coding Categories (cont.)

Category	Definition	Example	Coding Guidelines and Comments
Cost Effectiveness	Costs vs. savings Investment of client time & effort	'There was clearly simply a cost benefit in doing it ... we inducted 450-500 people in the last 12 months, if you worked out the hours...' HeavyIndustry[1]	On what basis or calculations do they know?
Transaction Efficiency	More inductions using fewer resources	I mean the amount of people we induct ... probably wouldn't have been able to cope with the amount 3,0000 or 4,000 up front and then there's still 30, 40, 50 people a month ...' SeaPort[1]	The number of inductions is tabulated in Chapter 4
Profits traded away before they hit the bottom line	Benefits obtained that don't necessarily reduce costs	'Reduction in our costings – will allow me more time to get on with the more productive side of my job if you will – the money making part.' SeaPort[3]	Client unlikely to know enterprise bottom line. Use questions about possible reduction in department budget to determine local bottom line
Evolutionary vs. Revolutionary 'Take the leap'	Was the change seen as evolutionary or revolutionary? What induced client to 'take the leap'?	' Revolutionary. Our training style, our thinking around training is very 1960's.' HeavyIndustry[2] 'Capacity, imaging, consistency.' HeavyIndustry[2]	
Future Use	Intention for future adoption	'This is how we will go with all our inductions now because we have a different induction for each project and I'd say they'll all be done basically the same ... they do a really good job.' Services[2]	Identify any intention to revert to older methods

The transcribed interview text was decomposed by category using cut-and-paste into a spreadsheet matrix with a column per category and a row per interview. Text that touched on more than one category was duplicated in each. Text that potentially represented new categories was placed in an ‘other’ column and expanded into additional categories as required. A sample portion of the spreadsheet is provided in Appendix B. Close reading, revision and analysis of the decomposed interview data resulted in the addition of four categories as shown in Table 3-7.

3.11.3 Thematic Analysis and Reporting

The thematic analysis of the decomposed categories was then carried out. Close reading of the coded categories allowed identification and counting of themes. Depending on the nature of the data, the results were reported in one or more of a number of reporting formats. All counts were reported as firstly a percentage and then in a ‘number out of’ format. The percentages were rounded to one decimal place thus providing the possibility of a total greater than 100%. The number out of format did not count blank cells or non-responses. For example, 29.4% (5/17) means five of 17 responses (out of a possible maximum of 17 responses). The reporting formats (with examples) include:

- **General themes supported by illustrative quotations (generally provided for all categories):**

‘Online training is now freed up our training room so we can utilise it for other training that we may require.’ Airport[1].

- **Counting of themes:**

47.1% (8/17) of the participants indicated their intention to adopt additional multimedia OHSE inductions in the near future

Table 3-7 Additional Coding Categories

Category	Definition	Example	Coding Guidelines and Comments
Problems	Any difficulties with the development, implementation or operation of the inductions	' If you don't get it right, the little things stand out ... if someone in the screen shot is not wearing their PPE ... sometimes we've let things through and until we get another chance to update that, it stays there.' Agriculture[1]	Includes problems with operation, filming and scripting
Languages & Literacy	Use of other languages Issue of lack of literacy	' It's not like giving someone a document and saying read it where the person can say 'Well I didn't really understand – I can't read very well'. ' SeaPort[3]	Inclusion of plans for other languages Legal requirements for English Problems with literacy (with English speakers)
Quality System & ISO Audits	Assistance with meeting quality standards	' We have auditors comment positively on it ... we're certified to 4801 type of quality, and environment.' HeavyIndustry[1]	Quality systems not product quality
Other	Significant issues, applications or impacts not otherwise accounted for in practice or anticipated by theory	'One aspect you could look at is that when we win tenders and contracts as a company because of our structure now with that induction.' Services[1]	

- **Comparative frequency of themes (table or bar chart):**

See sample in Figure 3-6

An axial analysis was then conducted by close reading along each of the rows and columns of the decomposition looking for any pattern of dissimilar experiences being related to with or between industry sectors.

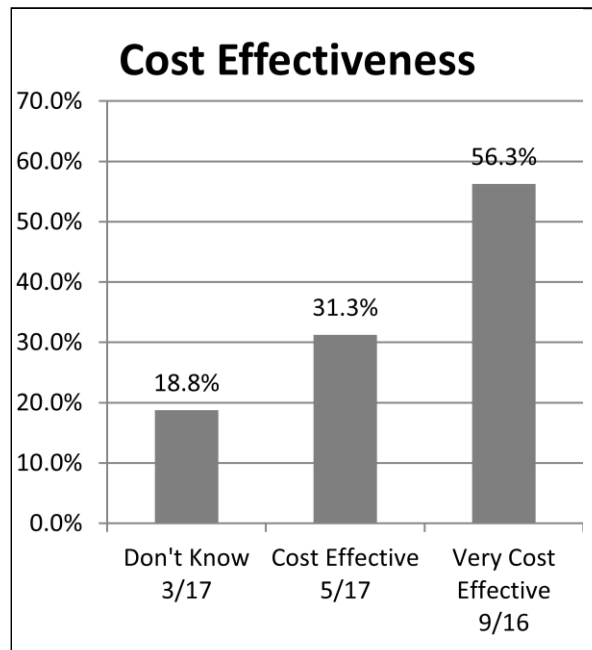


Figure 3-6 Sample: Cost Effectiveness

3.11.4 Quantitative Analysis of Frequency Counts

Comparative frequency count data is ordinal – each count is nominal, ordered and sequential with respect to its peers in terms of frequency. This allows groups or sub-sets with similar attitudes to be classified by counts or percentages.

The analysis of frequency count data may not go further than min/mode/max and count/percentage without making the assumption that the data are related by ratio. To assume so infers the existence of an underlying continuous variable which the results are only sampling (Jamieson 2004). The handling of frequencies scores as samples of a continuous variable is common in many studies. In addition, the use of measures such as mean and standard deviation make further assumptions that the underlying variable is (or tends towards being) normally distributed. Any skewed frequency counts indicating a polarisation of opinion undermines this assumption. This qualitative research does not investigate or make any assumptions concerning the possibility of any underlying,

continuous, normally distributed variables. Therefore, mean, standard deviation, and other quantitative statistical measurements such as correlation coefficients are not applicable.

3.12 CONCLUSION

This chapter described the research methodologies on the author's perspective to this research, the scientific perspective of the research, the justification for the use of the case study and practice-oriented case study methodology, the source and choice of the case study units, the issues arising from elite interviews, the inclusion of exploratory and confirmatory case study units, the structure of the qualitative data analysis and factors involving the execution of the research. Yin (2003a) recommends just such an analysis as implemented in this research for a descriptive study based on a theoretical framework with pattern matching between multiple case study participants.

In Chapters 4 and 5 following, we present the results of the research obtained with the methodologies described in this chapter.

Chapter 4 PRACTICE-ORIENTED ANALYSIS

4.1 INTRODUCTION

In this chapter we present, examine and discuss the data garnered from the interviews, descriptive analysis of the OHSE inductions and other sources that relate to the practice of multimedia OHSE inductions. As a prelude to investigating theoretical aspects of the multimedia paradigm shift, the multimedia OHSE induction model is described and compared to traditional methods. The multimedia OHSE inductions are subjected to a descriptive analysis that examines delivery modes, content, media and multimedia techniques.

4.2 MULTIMEDIA VERSUS TRADITIONAL MODEL

While it is axiomatic to attribute post-adoption use of multimedia in OHSE inductions to usefulness, we need to compare the pre-multimedia to post-multimedia delivery models in order to identify those aspects of usefulness that are pivotal to the paradigm shift. The multimedia model of OHSE inductions differs significantly from the traditional paper or classroom-slide show based methodology. This section describes and compares the multimedia OHSE model of the organisations included in this research in respect of the research question:

Q1.0: In what ways and in what manner are multimedia OHSE inductions being implemented? How does this differ from previous implementations?

Multimedia OHSE inductions differ from traditional methods in terms of the trainer, the classroom, the training schedule, the training materials and delivery mode. The problems and constraints of each of these induction elements were highlighted in the enterprise interviews and confirmed by the author's experience.

4.2.1 The Trainer

One of the obvious (and often expensive) problems faced when employing live trainers for inductions is the requirement that the trainer be present during the induction.

Trainers often have other duties and may not be available at the desired time or place. In addition, a trainer must have a backup to cover other absences such as sick and annual leave periods, external training sessions, and so forth. One trainer can easily become two or even three.

The quality of training also depends on the trainer. The quality of delivery and content varies between trainers and may vary for the same trainer between sessions as memory and mood may dictate.

Ideally, the trainer should be a person with formal training qualification (a 'trained trainer'). In times of high demand for inductions and low availability of staff, it is not difficult to imagine that the main qualification of the person chosen to give an induction is that they are the only one available at the time. The trainer should also be a person knowledgeable in the specifics of the local industrial or commercial processes including hazardous materials handling, emergency protocols and local conditions or variations to industry standards. This knowledge is often of a complex or technical nature.

The gender, age, language skills, teaching skills and experience of the trainer may all have an effect on the training outcome. For example, a discussion of the sacred objects used for male initiation rites at Australian Aboriginal sacred sites, delivered by a young woman and spoken with a strong American accent is likely to cause significant cultural offense. Locating a Mandarin speaking trainer who is familiar with the Aluminium production process late on a Friday afternoon to induct a group of visiting Chinese government officials can pose some significant challenges.

With multimedia, the ‘trainer’ is recorded once within the content of the presentation and is not then required to be present at each induction. The knowledge base of multiple trainers can be captured. The induction can then be run on a company’s premises and be supervised by security or other none-OHSE qualified staff.

4.2.2 The Classroom and Training Schedule

It takes the same training resources to conduct an induction for one or a room full of inductees. The training premises or trainer may not always be available (often having other duties as well as training). As a result, training sessions are often scheduled for the convenience of the OHSE staff rather than for the effective benefit of the enterprise.

Inductees do not present themselves for induction in a coherent manner. Delays and wasted time are accumulated while inductees wait for scheduled induction times.

Inductions are also traditionally given at specified locations. If the inductee is not at that site, location, city or country, they cannot be inducted. Induction facilities are a limited resource – if the training room only holds 15 people, that is all the people that can be

inducted in a single session. In the author's experience (and most OHSE professionals can relate similar instances), it is not uncommon for contractor staff arriving late on a Friday afternoon of a long weekend - perhaps to repair a major breakdown - to have to wait three or more days before receiving the inductions necessary to enter a site.

Multimedia training can be completed anywhere there are facilities - the only temporal or geographic restrictions on the delivery of multimedia inductions are the availability of multimedia presentation systems or web connectivity. While inductees can be directed to company supplied PCs or DVD-Video players in company provided training facilities, companies are increasingly providing the inductees with CDs, DVDs or on-line web links to allow them to complete the training prior to coming to site. The training occurs on the inductee's time and away from the company's site.

4.2.3 The Training Materials

The consistency of traditional OHSE inductions is dependent on the quality of the trainer delivery and the quality of the training materials. While there may be a written script or notes for the trainer to follow while speaking to slides, some material can be skipped, modified or embellished at the discretion of the trainer.

Due to the dynamic nature of industrial sites, industrial law and OHSE policy, traditional training materials are often inaccurate, incorrect or out of date. An example would be the recent policy and law changes regarding the use of mobile telephones while driving which must be incorporated into the induction materials. As shown from the case study participants' interviews in Chapter 5.3.2, multimedia was perceived to be

capable of being quickly updated cost effectively— especially as compared to video movies.

With multimedia training, the training materials are recorded once within the content of the presentation. Expert commentary can be given by suitably qualified staff without fear of misinformation being given at a later date by an unqualified person. What was previously a four day induction for everyone can become a one day induction for most people, a two day induction for others and a four day induction for the minority. This efficiency is gained through the use of tiered menus.

4.2.4 Tiered Menus

Preceding the content, a multimedia OHSE induction usually presents an interactive menu. The menu may be as simple as a single chapter level selection or as complex as a multi-level, tree structured system. Inductees have different induction and training requirements. In the traditional model, all inductees have to sit through the entire induction. Many segments are therefore either meaningless or not detailed enough for the purpose. With multimedia, complex menu structures can easily direct appropriate training to be given to the correct group.

The Multimedia Company often refers to ‘multimedia time’. This term is used to reflect the reduction in induction time that can be achieved with prepared, professionally produced, multimedia materials versus stand-up training methods. This reduction is often several fold. In a typical instance reported by The Multimedia Company, a two day, eight hours per day, first-aid course was reduced to one day of multimedia training

in the student's own environment followed by one day of formal classroom training. The first day's multimedia training took on average 3.5 hours to complete versus 8 hours of classroom training time. The training organisation halved its training facility and instructor overheads for the course.

4.2.5 Single/Group Mode

The menu may also include a choice of 'single user' or 'group' modes. In 'group mode', the presentation is not under the control of the inductee(s). The presentation is started and runs to completion without further intervention. Alternately, the trainer may run one section or module and then speak to that subject adding additional materials or soliciting questions. If a competency assessment is included, the questions will be displayed on a screen to the group and the answers written on paper answer sheets. In 'single user mode', the presentation is run under the control of the inductee. The inductee may either run the entire presentation from start to finish with pauses at each section or may select one module at a time from a multi-choice menu. The single user may view or repeat modules at their own pace. The single user may or may not be allowed to fast-forward through a module.

If interactive scenarios are included (for example 'Click on the eight hazards in the picture of this workshop'), the single user participates in each scenario as it appears.

4.2.6 Competency Assessment (Quiz)

One of the most attractive features of interactive multimedia is the inbuilt competency assessment. At the end of a single user mode induction, the user is presented with a series of questions about the material – usually multiple choice or true/false - picked at random from a prepared pool of questions. Should the user answer a question incorrectly, he is returned to the section concerned for a review of the material before re-attempting the question.

At the conclusion of the assessment, a report is generated and either printed, e-mailed, SMSed or sent to an enterprise file server. This report includes metrics on the length of time spent on the test, number or incorrect answers, making it difficult if not impossible to counterfeit.

In group mode, the assessment may be executed by displaying the questions on a screen and having the participants use paper answer sheets.

4.2.7 Summary of Model Differences

Use of the multimedia OHSE model paradigm can reduce or replace reliance on the presence and/or availability of the trainer, the training room, the training materials and the training schedule.

Using multimedia, there is no need for a qualified and knowledgeable trainer. The quality of the trainer is therefore not dependent on availability, training qualifications or

variations within trainer presentations. Age, gender, language skills, experience, and multi-cultural requirements can all be determined ahead of time and incorporated in the presentation. Expert technical content can be gained once and repeated accurately without further cost. Most of the overhead associated with trainers can be avoided by removing the necessity of having them present during inductions. If an induction is run on a company's premises, supervision may be provided by security or other less expensive staff.

Multimedia OHSE inductions free the trained training staff to perform other, more challenging work better suited to their qualifications. These activities can include incident investigation, on-the-job training and work practice observation.

Multimedia inductions eliminate the limitations of training schedules and venues. Inductees can often complete their training prior to coming to site. The training occurs on the inductee's time and away from the company's site.

Multimedia inductions eliminate the need for additional training materials such as booklets or handouts – the multimedia is the training material. By providing the inductees with the training materials directly, the companies may also avoid the cost of outsourcing training to third parties. With multimedia training, the quantity, quality and consistency of training is assured across time.

4.3 DESCRIPTIVE ANALYSIS OF THE INDUCTIONS

In this section, the classification categories are defined, the tabulation tables presented and the results discussed in order to illuminate the usage, practice-oriented implementation aspects of the multimedia OHSE inductions.

4.3.1 Induction Mode and Format

Table 4-1 contains the descriptions of the categories presented in the tabulations in Table 4-2. Previous format in Table 4-2 may be compared with the list of multimedia techniques in Table 4-11 that replaced them.

Table 4-1 Induction Mode and Format Categories

Category	Comments
Previous Format	SS = Slide Show Paper = Manuals, SOPs, printed material, etc. Video = Video played from VCR (no interaction)
Staff	Enterprise employees
Contractors/Casuals	Outside workers grouped together
Visitors	
Inductions pa	Total estimated inductions per annum
Tiered Menu	Tiered menu as described
Length mins	Total length of the induction in minutes – total of all inductions when multiple induction evaluated
# Chapters	Number of selectable portions of the induction to which one could navigate or fast-forward
Min/chap	Average minutes per chapter
Single /Group mode	Single/Group mode as described
Quiz	Competency Assessment as described

Table 4-2 Induction Mode and Format

	Previous Format		Target Audience			
Case Study Unit		Staff	Contract Casual	Visitors	Inductions p/a	Tiered Menu
Primary Industry						
Mining[1]	SS	X	X	X	3-5,000	
Mining[2]	None	X	X	X	1,000	X
Mining[3]	Unknown	X	X		Unknown	X
Agriculture[1]	Paper Video	X	X	X	1,000	
Agriculture[2]	Paper	X	X		2,000	
Manufacturing						
Construction[1]	Paper	X	X	X	1,000s	
Construction[2]	Paper	X	X		2,500	
HeavyIndustry[1]	SS	X	X	X	2,500	
HeavyIndustry[2]	SS	X	X	X	500	X
DiverseGoods[1]	None	X		X	1,425	X
Transportation						
Airport[1]	SS	X	X		Unknown	
Airport[2]	Unknown	X	X		1,000	
Seaport[1]	SS	X	X	X	600	X
Seaport[2]	SS	X	X		2,500	
Seaport[3]	SS Paper	X	X		100	
Haulage[1]	Paper	X	X	X	500	X
Haulage[2]	Unknown	X	X	X	Unknown	X
Services						
Services[1]	SS	X	X		1,115	
Services[2]	Paper	X	X	X	600	X
Utility[1]	Paper	X	X	X	1,000	X
Utility[2]	Unknown	X	X	X	Unknown	

One established company, DiverseGoods[1], had no OHSE induction process in place prior to the adoption of multimedia. Mining[2] was a newly created company without and also had no prior induction methodology in place. The other participants employed the traditional OHSE induction model as described in Chapter 1. Six of the companies relied wholly or partially on printed materials for their primary OHSE systems. This may seem a bit surprising in the computer age, however written inductions at the local level where inductees are taken through a written or picture book induction identifying local hazards, evacuation procedures, fire extinguisher locations etc. are still common.

DiverseGoods[1] does not employ contractors and for this reason it is the only company not to have contractor inductions. Only six of the companies did not have a visitor induction. Visitor inductions are usually a smaller version of the main staff/contractor induction that is given as a financial inducement in the sales process.

The high numbers of inductions per annum as shown in the table is indicative of the production capability of multimedia. While the case study participants could provide no figures on the number of inductees processed using traditional methods, they employed simple arithmetic to demonstrate that using training time, training facilities and locations and the necessary number of qualified trainers, they could not have achieved the level of multimedia inductions using the old methods. Re-induction of staff on a calendar basis or after a long absence from site is becoming more common.

While there is significant variation in the length and number of chapters/subjects in the inductions, the length per chapter/subject remains relatively constant. Figure 4-1 shows the distribution of chapter length times as a frequency histogram with approximately 50% of the chapters having a duration of one minute or less and approximately 75% with a length of 1.5 minutes or less. The Agriculture[2] outlier of more than 10 minutes per chapter was influenced by some chapters being as long as 30 minutes, covering many subjects, but having no navigational capability. While pedagogical issues were specifically excluded from the study as discussed in Chapter 1.8.6, it is none the less interesting to note the case study participants' belief in the short term attention span of their audience. The ability of multimedia to command attention was often mentioned as a positive feature of the inductions.

All of the participants included the single user mode implementation with only two not also employing group mode. This reflects the paradigm shift away from group inductions to individual instruction with the ability to go back to previous material.

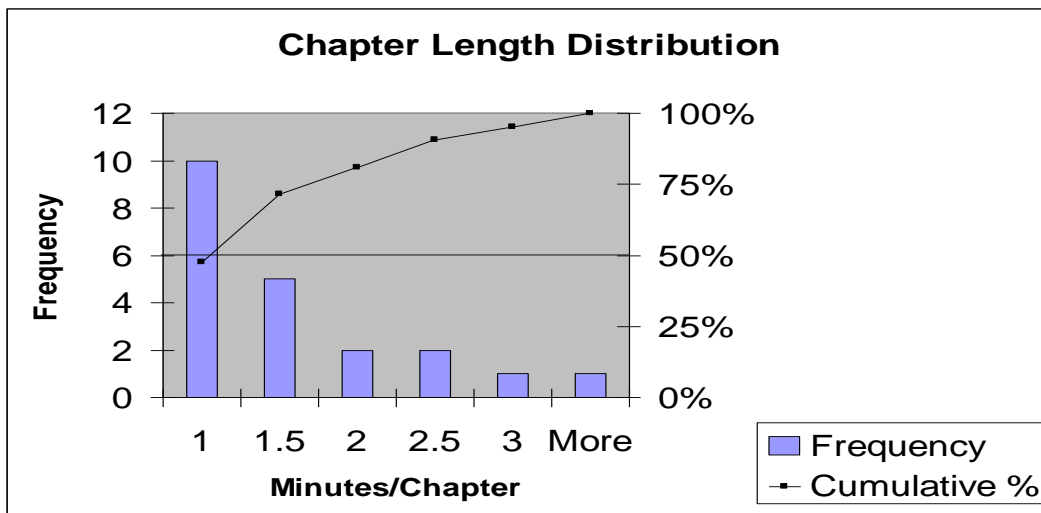


Figure 4-1 Chapter Length Distribution

Only three of the case study participants did not take advantage of the benefits of an interactive assessment (quiz). Two inductions for Mining[1] – a general company induction and a mining specific induction - were amalgamated for reporting. One had an inbuilt quiz, the other had a manual quiz administered after every four sections.

Agriculture[1] presented five sections, executed a manual quiz and then took a five-minute break before the next five sections. This may have been tailored to suit their large number of casual/seasonal employees. Airport[2] was required by law to have a printed/manual quiz for access to secure areas. Seaport[2] presented groups of three sections followed by a short, imbedded quiz.

Tiered menus as discussed in Chapter 4.2.4 were employed by nine of the users.

Interviews with The Multimedia Company employees indicated that most new inductions make use of tiered menus.

4.3.2 Induction Content: General

The contents of the inductions reflect the subjects chosen by the case study organisations as being important to OHSE outcomes and for which they wish the inductees to have an unambiguous knowledge. For the purposes of reporting and analysis, the induction contents have been divided into three sections – policies, risks and hazards and specific procedures. These divisions flowed naturally from the data and were not preconceived.

Where multiple subjects have been included within a category (for example sexual harassment and stealing), inclusion of content for any one of the subjects warranted a ‘tick’ for that category. The Utility[1] induction was mainly targeted at inducting personnel intending to visit remote sites and did not have any content in many categories. It will not generally be included the following analysis.

4.3.3 Induction Content: Policies

The subjects in this grouping of content are intended to deliver the enterprise’s general policies and stance on OHSE matters. Table 4-3 contains a description of the categories tabulated in Table 4-4.

Table 4-3 Policy Descriptive Categories

Induction Content	Comments
CEO Address	An address usually presented against a background of company activities ('blue screen')
Company Intro	The background, business activities and location(s) of the enterprise and its markets
OHSE Policy	Statement containing the company's OHSE policies and goals, rehabilitation and return to work policies, and safety groups and committees
Behave/Conduct	Acceptable workplace behavior including equal opportunity, discrimination, harassment (sexual, racial, and religious), exclusion, bullying, horse play, practical jokes, fraud, stealing, fighting, sabotage and firearms
Legislate/DOC	Details of any legislative requirements under which the employee and the company's OHSE systems works, and/or specification of the company's/individual's DOC
Community Relations	The company's and employees responsibilities in relation to the community at large and special interest groups (for example Aboriginal Peoples)
Customers Relations	Requirements and protocols for employees to follow when dealing with the company's clients
Quality Manage	The Quality Management System and any special employee requirements
Environ/Green	Environmental policies including Aboriginal heritage sites, flora, fauna, habitat rehabilitation, hydrocarbon spills and any 'green' initiatives such as recycling, energy saving and greenhouse gases
Fit Work/Fatigue	Fitness for work, stress and fatigue information
Drugs/Alcohol	Drug and alcohol policies, testing obligations, requirements and procedures, and drug/alcohol rehabilitation procedures
Use of Mobile Phones	The company's policy concerning the operation of mobile telephones while driving vehicles
Email/Internet	Policies concerning personal use of the company's networks for email and accessing the internet
Smoking	Policies concerning smoking in the workplace – what and where smoking may be allowed

Table 4-4 Induction Policies

Case Study Unit	Content									
	Incident Reporting	Risk JSA Take-2/5	Prestart Toolbox	Observe Behavior	Access Security	Fire Evac	First Aid	Hazard Risk	Licenses Certif	Permits
Primary Industry										
Mining[1]	X	X	X	X	X	X	X	X	X	X
Mining[2]	X	X	X	X	X	X	X	X		X
Mining[3]	X	X	X	X	X	X		X	X	X
Agriculture[1]	X		X			X	X	X		X
Agriculture[2]	X	X			X	X	X	X		X
Manufacturing										
Construction[1]	X	X	X		X	X	X	X		
Construction[2]	X	X		X	X	X	X	X	X	
HeavyIndustry[1]	X	X		X		X	X	X		X
HeavyIndustry[2]	X	X	X			X	X	X	X	X
DiverseGoods[1]	X		X	X		X	X	X	X	X
Transportation										
Airport[1]	X				X	X		X		
Airport[2]					X	X	X	X		X
Seaport[1]	X	X			X	X	X	X	X	X
Seaport[2]	X				X	X		X		
Seaport[3]			X		X	X		X		
Haulage[1]						X	X	X	X	X
Haulage[2]	X	X	X		X			X		
Services										
Services[1]	X				X		X	X		
Services[2]	X	X	X			X		X	X	X
Utility[1]		X			X					
Utility[2]	X	X		X		X		X		X

Only eight of the participants included a CEO address. This hesitancy may reflect the need to change the section with changes of CEO. Only four did not include a section that introduced the enterprise. These same four also did not include a CEO address perhaps indicating a lack of concern in promoting the company image. Only three participants included a section on community relations - two of these mining companies. It may be that community relations is considered to be a Public Relations (PR) issue rather than an OHSE issue and therefore not required for an OHSE induction. Only three of the participants included a section on customer relations. Two of those three were haulage firms who might be more 'retail-oriented' than say mining or construction companies. Again, customer relations may be considered to be a PR issue.

Every participant indicated that their organisation had quality systems and generally responded positively to the impact of multimedia on quality management. However, only four of the inductions mentioned their quality system. Two of those four that did include information on their quality management systems were Agriculture companies. The cause of this anomaly is open to speculation.

Nearly all companies (16/17) included information on at least one fitness for work issue including drugs and alcohol use, policies and testing, stress and fatigue.

A recent poll (Gold 2009) showed only 41% of companies have policies regarding use of social networks and the internet in the office. Surprisingly, only two of the case study inductions included such a policy. The same survey stated that one in four companies are now blocking access to social networking sites as they are seen as reducing

productivity. Even The Multimedia Company has recently turned off all access to instant messaging, social networking, email, email news and blogging sites due to abuse.

4.3.4 Induction Content: Risks and Hazards

The content in this grouping is intended to deliver the enterprise's policies and procedures concerning risk and hazard identification, assessment, handling and reporting. Table 4-5 contains the descriptions of the categories tabulated in Table 4-6.

As might be expected from a good OHSE program, incident reporting, risk analysis, emergency services and permit systems were heavily represented. Inclusion of an observation based safe working practice was included in seven of the inductions. The need to show required licenses and certificates prior to commencing of work was only included in eight of the inductions.

4.3.5 Induction Content: Specific Procedures

The content in this grouping is intended to deliver the enterprise's policies and procedures concerning specific procedures. Table 4-7 contains the descriptions of the categories tabulated in Table 4-8.

Table 4-5 Risk and Hazard Descriptive Categories

Induction Content	Comments
Incident Reporting	Defines an OHSE 'incident' (accident, hazard, breach, etc.) and how it is to be reported
Risk JSA,Take-2/5	Risk management procedures including Job Safety Analysis systems for reducing risk and Take 2/5 minutes for assessing new or possibly hazardous tasks
Prestart/Toolbox	Prestart checks that must be completed prior to operating mobile plant and equipment, procedures at the start/end of a shift/operation, and/or 'toolbox' (in the workplace, over one's tools) safety discussions
Observe/Behavior	Safe working observation systems where work procedures are observed either secretly or with the worker's knowledge
Access/Security	Access rights and policies (swipe cards, badges, driving areas) and any security requirements and policies
Emerg/Fire/Evac	Emergency notification procedures, telephone and radio channel numbers, what to say when reporting an emergency, fire extinguisher locations, fire fighting, evacuation and cyclone procedures
First Aid	The location and facilities of first aid stations
Hazard/Risk	Policies and procedures for hazard reporting and risk assessment. Hazards including chemicals, hot work, dust, asbestos, use of gloves, biological agents, hydraulic lines, compressed air, weather (lightning, cyclone), biological risks (plant and animal life) and special site related hazards are unique to each industry while working at heights, confined spaces and other universal risks and procedures have their own category
Licenses/Certif	Specifies the company's requirements for presentation of licenses and certificates prior to work requiring such documents being carried out
Permits	Describes the permit system needed for specialised types of work that include hot work, working at heights, working in confined spaces, electrical work, operating large plant and equipment (cranes, trucks, graders, etc.) and work requiring excavation

Table 4-6 Induction Risks and Hazards

	Content									
Case Study Unit	Incident Reporting	Risk JSA Take-2/5	Prestart Toolbox	Observe Behavior	Access Security	Fire Evac	First Aid	Hazard Risk	Licenses Certif	Permits
Primary Industry										
Mining[1]	X	X	X	X	X	X	X	X	X	X
Mining[2]	X	X	X	X	X	X	X	X		X
Mining[3]	X	X	X	X	X	X		X	X	X
Agriculture[1]	X		X			X	X	X		X
Agriculture[2]	X	X			X	X	X	X		X
Manufacturing										
Construction[1]	X	X	X		X	X	X	X		
Construction[2]	X	X		X	X	X	X	X	X	
HeavyIndustry[1]	X	X		X		X	X	X		X
HeavyIndustry[2]	X	X	X			X	X	X	X	X
DiverseGoods[1]	X		X	X		X	X	X	X	X
Transportation										
Airport[1]	X				X	X		X		
Airport[2]					X	X	X	X		X
Seaport[1]	X	X			X	X	X	X	X	X
Seaport[2]	X				X	X		X		
Seaport[3]			X		X	X		X		
Haulage[1]						X	X	X	X	X
Haulage[2]	X	X	X		X			X		
Services										
Services[1]	X				X		X	X		
Services[2]	X	X	X			X		X	X	X
Utility[1]		X			X					
Utility[2]	X	X		X		X		X		X

Table 4-7 Specific Procedures Descriptive Categories

Induction Content	Comments
Barricade/Signage	Physical systems that restrict or prevent access to dangerous areas
Driving/Mobile	Policies concerning the driving of automobiles or mobile plant (speed limits, right of way, access, 4WD use, etc)
Dress/PPE	Requirements for the wearing of work gear, uniforms and/or personal protective equipment (safety glasses, steel-toed boots, gloves, etc.)
Smoking	Policies concerning smoking in the workplace – what and where smoking may or may not be allowed
Ergonomics	Includes information on the correct methods of placing and working with office related equipment
Manual Handling	Describes correct manual handling practice
Electrical/Earth Leakage	Specifies the requirement for electrical cables and appliances to be checked and tagged on a regular basis and for all electrical cables and appliances to be protected by an earth leakage switch
Isolation/Tagging	Where electrical isolation of plant is required, this content describes the 'Out of Service' and 'Danger Tag' systems employed
Slips/Trips/Housekeeping	Safety information on slips, trips and falls in the workplace and sets out housekeeping requirements
H-Stress/Dehydrate	Information on heat stress, dehydration, cold stress, skin cancer, and UV exposure

Table 4-8 Induction Specific Procedures

	Content									
Case Study Unit	Barricade Signage	Driving Mobile	Dress PPE	Smoking	Ergo-nomics	Manual Handling	Electrical RCD	Isolation Tagging	Slips Trips Housekeep	H-Stress Dehydrate
Primary Industry										
Mining[1]	X	X	X		X	X	X	X	X	X
Mining[2]	X	X	X	X		X		X	X	X
Mining[3]	X	X	X	X		X	X	X	X	X
Agriculture[1]		X	X	X		X	X	X	X	X
Agriculture[2]		X	X	X		X	X	X	X	X
Manufacturing										
Construction[1]		X	X	X			X		X	X
Construction[2]	X	X	X	X			X		X	X
HeavyIndustry[1]		X	X	X		X	X	X	X	
HeavyIndustry[2]	X	X	X	X	X	X	X	X	X	X
DiverseGoods[1]		X	X		X	X	X	X	X	X
Transportation										
Airport[1]										
Airport[2]	X	X	X	X						
Seaport[1]		X	X	X			X	X	X	
Seaport[2]		X	X					X		
Seaport[3]		X	X	X				X		
Haulage[1]		X	X	X		X	X	X	X	
Haulage[2]		X	X	X						
Services										
Services[1]			X			X	X	X	X	
Services[2]	X		X			X	X	X	X	X
Utility[1]			X							
Utility[2]			X			X	X		X	

Airport[1] did not have any content in these categories. They did, however, have a series of videos such as ‘Air Side Driving’ that were not included in this study as being ‘educational’ rather than induction related. Only one company did not include a presentation on dress and PPE. Minimum requirements are generally a long sleeved shirt with a collar, hat (or hard hat), long trousers and steel capped boots. Given the nature of many of the enterprises in this study, it is surprising that only seven included information concerning barricading and signage. Prohibiting the use of mobile phones while driving was included in only seven inductions. Such use is now a matter of State law and like general traffic rules is possibly not thought worthy of specific inclusion. It may be worth noting that while use of mobile phones while driving is prohibited, no site bans use of company radios while driving (mic only or hand held). Ergonomics is given little voice in the inductions - while other specific areas are the source of common injuries, one seldom hears of repetitive strain injury claims these days. The inclusion of heat stress and dehydration by 10 companies appears to be related to working geography. Manual handling as the source of many back injuries, electrical safety as the source of many accidents and deaths, and isolation of plant and equipment being the source of many injuries are all given full sway in the inductions.

4.3.6 Induction Physical Media

Table 4-9 contains a tabulation of the physical media employed. All of but one of the video window sizes employed were DVD sized (720x576) or larger. Services[1]’s IT department restricted it from using on-line inductions. Use of DVD-ROM was not reported by any of the case study participants. The HDD, CD-ROM, and on-line formats were favoured due to their ability to include an interactive quiz. The DVD-Video

inductions were favoured at locations where only an inexpensive DVD player might be available. The Multimedia Company reports that on-line use is growing rapidly.

Table 4-9 Induction Physical Media

	Physical Media					
Case Study Unit	HDD	CD-ROM	DVD-ROM	DVD-Video	On-Line	Window Size
Primary Industry						
Mining[1]		X		X		800x600
Mining[2]	X	X			X	800x600
Mining[3]		X				800x600
Agriculture[1]				X		720x576
Agriculture[2]		X		X	X	720x576
Manufacturing						
Construction[1]	X					640x480
Construction[2]		X				800x600
HeavyIndustry[1]	X					800x448
HeavyIndustry[2]		X				
DiverseGoods[1]	X	X				800x600
Transportation						
Airport[1]		X			X	
Airport[2]				X		720x576
Seaport[1]		X			X	800x600
Seaport[2]		X		X		720x576
Seaport[3]		X			X	800x600
Haulage[1]		X			X	800x600
Haulage[2]	X	X				800x600
Services						
Services[1]		X		X		720x576
Services[2]	X	X			X	800x600
Utility[1]	X	X				800x600
Utility[2]		X			X	720x576

4.3.7 Induction Multimedia Techniques

Table 4-10 describes the multimedia techniques tabulated in Table 4-11. Generally speaking, the more techniques employed the more sophisticated and visually pleasing the presentation. The choice of multimedia techniques by the case study organisations reflects their desire and need to visualise aspects of their operations balanced by the cost

of multimedia production. Every induction included photo transitions (old style slide show). All but one induction included a graphic (diagram, graph, etc.) and over half animated their graphics. 3D stills were included in eight presentations with animated 3Dgraphics, 3D fly-thru and full motion 3D human figures being used in decreasing frequency due to increased cost. 3D full motion human figures were employed where using actors was impossible (e.g. showing unsafe working at heights). Despite its relatively high cost, video was employed in over half (12) the inductions – often with local staff playing roles. Sound effects were used effectively where sirens or other alerting device were employed. Music was seldom employed and was considered a distraction by most companies.

4.4 WITHIN/BETWEEN INDUSTRY SEGMENTS

The practice-oriented results were examined to determine if there were any within or between industry sector differences. In all but one respect, the inductions, as shown by the tabulations are remarkably similar. They use the same modes of presentation, included similar kinds of policies, have similar chapter lengths, use similar physical media and include similar multimedia techniques. Some difference in multimedia format may be attributed to early adopters opting for CD-ROM with later adopters favouring on-line. The biggest difference between the organisations is the number of inductions per unit time. What this highlights is the scalability of multimedia. Having been produced, a multimedia OHSE induction may be used to induct a few or hundreds with little change in the overheads.

Table 4-10 Multimedia Techniques

Multimedia Technique	Comments
Photo Transitions and Panning Photos	Client photos common throughout – over use of panning may cause motion discomfort
Video	Short segments of video covering both general subjects (site tour) and specific, important issues (access, hazards, important safety issues)
Blue Screen	CEO address against a blue screen video of enterprise activity
2D Still and Animated Graphics	Diagrams, charts, layouts, maps used as needed to illustrate the subject
3D Still and Animated Graphics	Used sparingly to bring greater realism or to illuminate specific subject. Cost may be a barrier to use.
3D Fly-thru	Used sparingly where understanding of large site, plant or equipment layout or operation is essential. Cost may be a barrier to use.
3D Full Motion Human	Used sparingly where photographs or video of humans cannot be obtained due to risk (you cannot film a worker falling off a 10-story platform!). Cost may be a barrier to use.
Sound Effects	Essential where sirens or warning level must be understood. May also be used as a background to add realism to a scene.
Animated Company Logo, music	Trivial for OHSE purpose's but can add polish to the induction

Table 4-11 Inductions Multimedia Techniques

	Multimedia												
Case Study Unit	Photos Transition	Photos Panning	Video	Blue Screen	Graphics Still	Graphics Animated	3D Stills	3D Animated	3D Fly-thru	Animated Logo	Full Mo Human	Sound Effects	Music
Primary Industry													
Mining[1]	X	X	X	X	X	X	X	X			X		X
Mining[2]	X	X			X		X						
Mining[3]	X		X		X	X							
Agriculture[1]	X	X	X		X	X					X		
Agriculture[2]	X	X	X		X	X	X	X	X	X	X	X	X
Manufacturing													
Construction[1]	X		X		X	X	X	X			X		
Construction[2]	X	X			X	X				X			
HeavyIndustry[1]	X		X	X	X		X	X					
HeavyIndustry[2]	X				X		X			X			X
DiverseGoods[1]	X		X	X	X	X	X						
Transportation													
Airport[1]	X	X			X	X				X			
Airport[2]	X	X	X		X	X			X	X		X	X
Seaport[1]	X		X		X							X	
Seaport[2]	X	X	X	X	X					X			X
Seaport[3]	X									X			
Haulage[1]	X		X		X	X							
Haulage[2]	X				X	X							
Services													
Services[1]	X		X		X			X			X		
Services[2]	X				X	X	X						
Utility[1]	X				X								
Utility[2]	X				X	X							

4.5 CONCLUSION

The practice-oriented descriptive analysis of the multimedia OHSE inductions contained in this chapter provides a before and after illustration of the paradigm shift comparison between the traditional OHSE induction and the practice that replaced it and answers the research question:

Q1.0: In what ways and in what manner are multimedia OHSE inductions being implemented? How does this differ from previous implementations?

The analysis in this chapter provides a window into the implementation, use, audiences, subject matter, logical and physical method of delivery and the multimedia techniques employed that current or future users can employ to improve education and practice. This practice-oriented data also provides the platform on which the thematic analysis carried out in Chapter 5 is based.

Chapter 5 THEORY-ORIENTED/THEORY-TESTING

RESULTS, ANALYSIS AND DISCUSSION

5.1 INTRODUCTION

In this chapter, the results of the theory-oriented/theory-testing research as garnered from diverse sources and the thematic analysis of the elite interviews are presented, discussed and compared to anticipated theoretical outcomes.

Results from the elite interviews were obtained by decomposition, coding and analysis as described in Chapter 3.11. Depending on the nature of the data, the interview results are reported in one or more of the following formats – illustrative quotations from the interviews, counting of themes, comparative frequency of themes and an axial matrix analysis. All counts are reported as a percentage to one decimal place and a ‘number out of’. For example, 31.3% (5/16) means five of 17 responses (blank responses not counted).

5.2 TECHNOLOGY-PUSH/MARKET-PULL RESULTS, ANALYSIS AND DISCUSSION

The research question related to Technology-Push/Market-Pull asks:

Q2.0: In what ways and to what extent have Technology-Push and Market-Pull forces been factors in the multimedia OHSE induction paradigm shift?

As reported in Chapter 2.9, the anticipated theoretical outcomes for Technology-Push/Market-Pull include:

- As technology is pushed to a new market, the market will in turn pull technical applications (Moore 1991; Bower and Christensen 1995; Walsh, Kirchhoff, and Newbert 2002).
- Technology-Push will be the source of disruption with the disruption diminishing over time (Walsh, Kirchhoff, and Newbert 2002; Bower and Christensen 1995; Christensen 2007).

In addition, we reported in Chapter 2.2 that the literature showed that a pure Technology-Push strategy is likely to be employed where the innovating firm has no established client base and where customer resistance to new technology is seen as the major barrier to adoption (Moore 1991; Bower and Christensen 1995).

To answer the research question, the source materials as described in Chapter 3.8.3 (historical promotional material, order books and emails) and in particular the historical copies of The Multimedia Company's old web sites as archived by the internet Wayback Machine (*Internet Wayback Machine*, <http://www.archive.org/index.php>) were examined and are summarised in Table 5-1.

The history of The Multimedia Company almost exactly matches these anticipated theoretical outcomes. The marketing banners and applications listed in Table 5-1 chronicle and reflect the Multimedia Company's journey from Technology-Push to Market-Pull. Multimedia was initially pushed to clients by The Multimedia Company

for digital advertising and industrial process visualisation. As the clients gained experience with multimedia, they asked for improvements, modifications and new applications – OHSE inductions in particular.

Table 5-1 The Evolution of Technology-Push/Market Pull

Year	Marketing Banner	Technology & Applications
1999-2001	'Remote Digital Outdoor Advertising'	Early 50" Plasma screens in industrial and outdoor environments Digital advertising
2002	'Enter the World of Multimedia'	Video CV's Industrial 'Scoreboards' combining KPIs (key performance indicators) and digital advertising
2003	'Multimedia for Industry'	Industrial process visualisations Multimedia presentations re industrial systems First multimedia OHSE inductions and safety presentations
2004-2005	'Industrial Multimedia' 'If you can describe it we can design it'	Over 50 OHSE inductions included in client list
2007	'Site Specific Induction Specialists'	Web site intro entirely given over to OHSE inductions 99.99% of business multimedia OHSE inductions
2008-2009	'Site Specific Induction Specialists'	On-line OHSE inductions Learning management databases Expansion of OHSE multimedia packages including a risk and opportunity management system and a training resource generator package

In this scenario, The Multimedia Company was pulled to OHSE inductions in contradiction to sources such as Bower and Christensen (1995), Walsh, Kirchoff and Newbert (2002) and Christensen (2007) that posit the push of a new technology as being the force behind disruptive change. How is this contradiction reconciled? At the time of this study, multimedia was not a new technology – computers able to integrate text, images, animation, audio and video were ubiquitous, high intensity graphs and interaction were common attributes of games and web sites. However, multimedia was a *new* technology as far as OHSE inductions were concerned. It might therefore be said that in this instance the push of a new *application* of an old technology was pulled by the market. Lasers were old technology at the time they were used to revolutionise data storage on CDs and DVDs – was that a push or pull situation? This ‘chicken and egg’ conundrum has led some researchers to propose more mixed/integrated perspectives and models of the push-pull duality (Klang 2006; Bernstein and Singh 2004; Howells 1997). ‘There appears to be broad agreement that a combination of these factors [innovation process, market and environmental influences, managerial issues] is instrumental to developing a better understanding of the innovative process from an integrated perspective.’ (Bernstein and Singh 2004 p561).

Whatever the source of the disruption/change (as described by the participant interviews), as time passes, the disruptive influence of the new technology is expected to diminish (Walsh, Kirchhoff, and Newbert 2002). This position is supported as none of the case study participants indicated any anticipated problems with the introduction of the next tranche of multimedia OHSE inductions. While the multimedia technology itself was not the source of the disruption, the level of multimedia technology employed

(e.g. 3D vs. 2D) in OHSE inductions has diminished over time as shown in Chapter 5.9.1.

The findings in this research add to the body of theoretical Technology-Push/Market-Pull literature. The general Technology-Push/Market-Pull theory was validated as it was shown that the multimedia technology that was initially pushed to the market as an industrial tool for doing advertising, process visualisation and education was pulled by the market towards OSHE site specific inductions. The theory that the technology pushed would be disruptive was not supported – the market-pulled technology was the disruptive element.

In response to the research question

Q2.0: In what ways and to what extent have Technology-Push and Market-Pull forces been factors in the multimedia OHSE induction paradigm shift?

the anticipated and actual outcomes of the research as discussed in the preceding paragraphs are summarised in Table 5-2.

5.3 MARKETING RESULTS, ANALYSIS AND CONCLUSIONS

The research question related to marketing asks:

Q3.0: In what ways and to what extent have USPs and Product Positioning arguments been influential in the adoption of multimedia OHSE inductions?

Table 5-2 Technology-Push/Market-Pull Theoretical Outcomes

Innovation Theory	Anticipated Theoretical Outcomes	Conclusions
Technology-Push Market-Pull	Technology will be pushed to a new market, the market will in turn pull technical applications (Moore 1991; Bower and Christensen 1995; Walsh, Kirchhoff, and Newbert 2002)	Supported – this was the path followed
Technology-Push Market-Pull	Technology-Push is the usual source of disruption (Walsh, Kirchhoff, and Newbert 2002; Bower and Christensen 1995; Christensen 2007) Disruption will diminish over time (Walsh, Kirchhoff, and Newbert 2002)	Not supported – market pull was the source Supported

As reported in Chapter 2.9, the anticipated theoretical outcomes for marketing include:

- Assertions concerning the unique benefits and advantages of OHSE multimedia inductions (USP) will be strong incentives to adopt (Reeves 1961).
- Product Positioning of OHSE multimedia inductions against other products, trusted authorities, celebrities, or the ‘herd’ will provide strong incentives to adopt (Hoteling 1929; Ries and Trout 1986).

5.3.1 Unique Selling Propositions

As discussed in Chapter 2.3.2, a USP describes a marketing strategy where propositions are made to a prospective adopter concerning the features, benefits and advantages of a product that are (i) unique and (ii) significantly better than those offered by competing products and (iii) compelling (Reeves 1961). The USP strategy does not include direct

comparisons or disparagement of a competing product (Product Positioning). In the participant interview responses, there were no instances where these three elements were present.

A USP requires product competition. In the first instance, existing systems such as live classroom presentations, paper based and video movies may not have been perceived as being competitive. As an example of this situation, consider video security cameras. Their only ‘competition’ is manned security stations. Presenting the cameras as having a unique and significant benefit of requiring maintenance only once per year would probably not be a successful marketing strategy. Secondly, there were no competitive suppliers. In no instance did the participants obtain competitive quotations and often committed to a purchase upon sight.

USP theory arose from markets with many similar competitors (beer, washing powder, automobiles) and is likely to be more applicable to similarly crowded markets. In a future competitive market with multiple suppliers of multimedia inductions, USPs would most likely prosper.

5.3.2 Product Positioning

As discussed in Chapter 2.3.3, Product Positioning theory as originally proposed by Hotelling (1929) asserted that consumers assessed a product’s utility by comparing its attributes to the alternatives. Ries and Trout (1986) popularised the advertising concept of Product Positioning which differs in emphasis from Hotelling’s construct in that products need to be positioned against other known products, trusted authorities,

celebrities, heritage or the 'herd'. The majority (58.8% (11/17)) of the participants identified perceiving that the 'herd' - other companies not necessarily in the same industrial sector - were adopting multimedia for OHSE inductions as being an incentive for them to purchase the product. This is illustrated by the following sample quotations from the interviews:

'He showed us what the company had already done. And there is I think [another] Port Authority. There were a couple of mining companies and that actually shows us that these things were actually in place - gave a lot of credence to the sort of program. So if it's accepted by other industries, that is a big thing.' SeaPort[1].

'I think the difference between what they provided to us and what other people had provided to us was that there was tangible evidence of systems that were running in large corporations, large mining corporations where the risk is not dissimilar to our own.' Haulage[1].

In the interviews, 47.1% (8/17) of the participants identified Product Positioning propositions of multimedia versus video. Of these, 75.0% (6/8) identified the ability of multimedia to be easily updateable as compared to video as an influencing factor as illustrated by the following sample quotations:

'The key critical thing that attracted me was the ability to update. The proposition that always sticks in my head was a pin board and that I could take out this snippet of film, this pin, and replace it. So the upgrade path was low

cost - that was what was compelling to me. And that was why I went, because we were suffering with this film issue where I just wasted \$60,000 18 months before and it's out of date.' Agriculture[1].

'The best thing that we've introduced so far by multimedia is the ability to update. And it's more versatile and the one thing needs to be changed, it's not re-recording everything. So from a financial perspective the costs are actually lower than other products rather than re-doing everything.' Mining[1].

'What continually sells it, at the moment, and what is being proposed for the use on the other sites is how easy it is to use and how easy it is to modify things. That's probably the thing that's coming across.' HeavyIndustry[1].

'[We] went out and got some filming done. It was very expensive, it was out of date within six months, changed uniforms even. So it basically became obsolete and wasn't used almost 12 months after - which was a significant disappointment. The key critical thing that attracted me was the ability to update. That is critical.' Construction[1].

5.3.3 Marketing Theoretical Conclusions

The USP theory of marketing success was not supported – adopters did not perceive any USPs that were persuasive. Being a new entry to the OHSE induction market, it wouldn't have been surprising if multimedia was seen as having unique selling propositions. However, it is likely that the participants did not perceive multimedia as being a direct competitor to their existing system and therefore not requiring unique and

significant differences as a basis for purchase. Alternately, the extensive exposure of the general population to multimedia techniques through computer games, entertainment and web pages may have relegated multimedia to the 'common' bin.

The interviews illustrated two aspects of the effectiveness of Product Positioning – the comfort derived from seeing in sample inductions presented to them by The Multimedia Company that others (the 'herd') were adopting a similar product and the highlighting of multimedia as being easier and less expensive to modify as compared to video. The first aspect supports Ries and Trout (1986) in respect of the 'herd' but not in the need to position products against other trusted authorities, celebrities or heritage. The second aspect more closely matches the original Product Positioning construct of Hotelling (1929) in demonstrating the consumer's evaluation of comparative product utility.

While cost and time savings may have later been used as justifications for future adoption, they were not initially sales sensitive issues. It may initially be perplexing that cost effectiveness and efficiency (identified by all users in one aspect or another) were not perceived as marketing inducements. While none of the case study participants reported being approached or induced to purchase on the basis of reduced cost or improved efficiency, these are the same arguments that the participants later reported using to justify future adoption. This may be explained in the context of perceived usefulness – for what purpose did the participants envisage employing multimedia in their inductions? If the initial aim was to reduce costs and improve efficiency, then the perplexity remains. If, however, the adopters' aim was to create a better induction by reducing equivocality and providing a higher quality learning experience, then the perplexity is dispelled.

In response to the research question

Q3.0: In what ways and to what extent have USPs and Product Positioning arguments been influential in the adoption of multimedia OHSE inductions?

the anticipated and actual outcomes of the research as discussed in the preceding sections is summarised in Table 5-3.

5.4 THE TECHNOLOGY ACCEPTANCE MODEL RESULTS, ANALYSIS AND CONCLUSIONS

The research questions related to the TAM/TAM2 ask:

Q4.1 To what extent have multimedia OHSE inductions been easy to use?

Q4.2 In what ways and to what extent have Subjective Norm, Image, Job Relevance, Output Quality and Demonstratability been influences in the adoption of multimedia OHSE inductions?

Q4.3 What is the intent for future adoption of multimedia OHSE inductions?

As reported in Chapter 2.9, the anticipated theoretical outcomes for the TAM/TAM2 support the proposition that the following TAM/TAM2 constructs will be important factors in the initial adoption, current practice and future implementation of multimedia.

Table 5-3 Marketing Theoretical Outcomes

Marketing Theory	Anticipated Theoretical Outcomes	Conclusions
Unique Selling Proposition	Propositions concerning the unique benefits and advantages of OHSE multimedia inductions would be strong incentives to adopt (Reeves 1961)	Not supported – USPs not perceived by adopters
Product Positioning	Consumers gain utility by comparing product attributes (Hoteling1929) Products need to position themselves against other products, trusted authorities, celebrities, or the 'herd' (Ries and Trout 1986)	Supported – video compared unfavourably to multimedia Supported for the 'herd' but not trusted authorities or celebrities

for OHSE inductions (Rogers 1962, 5th Ed. 2003; Moore 1991; Davis 1989; Davis, Bagozzi, and Warshaw 1989; Venkatesh and Davis 2000):

- Perceived Usefulness (PU)
- Perceived Ease of Use (PEOU)
- Demonstratability
- Job Relevance and Output Quality
- Image
- Subjective Norm - directly in mandatory situations and indirectly via PU

(Hartwick and Barki 1994; Moore and Benbasat 1991; Venkatesh and Davis 2000)

5.4.1 PU and Negative Usefulness

In Chapter 2.4.9, it was argued that while the TAM/TAM2 identifies the *belief* construct Perceived *Usefulness*, it does not touch on the nature of actual *usage*. Chapter 4 steps beyond the pre-adoption belief construct of PU and describes the actual post-adoption usefulness of multimedia for OHSE inductions. PU is therefore not addressed in this chapter of theory-related research questions.

While negative usefulness may not be a theoretical construct, it is reported in this chapter as the following data describing problems with multimedia for OHSE inductions was derived from the participant interviews - the principal source of theory-testing data.

The participants were directly asked if they had had any negative experiences in using multimedia for OHSE inductions. Three kinds of problems were reported: problems with script development (50.0% (5/10)), initial problems with equipment (30% (3/10)) and problems related to what was filmed/videoed (20% (2/10)).

Scripting was mentioned as being a difficulty rather than a negative aspect of producing the inductions. In the scripting process, a professional writer from The Multimedia Company gathers the materials for the induction and produces a frame by frame text script for the narration voice over. This script is sent to the client for approval. Once the script is approved and returned, the creative graphic designer adds descriptions of the visual graphics to accompany each slab of narration of the induction, the images,

graphics, animations and video/film are located or captured and the induction is produced. The completed work is returned to the client for final review.

Getting script approval from all the stake holders within the participant companies for the wording of the voice over narration can be a difficult exercise. Often the script is either ignored (too hard basket) or, because every department can have an opinion, becomes the subject of word by word internal fights. The Multimedia Company highlighted script approval as the most delay prone phase of any project. As a result, The Multimedia Company sets time limits for approval after which they will proceed with the submitted script with any variations to be done at additional expense to the client. Participant comments included:

‘We thought our materials and procedures were okay to be translated. I mean when I took over this project I was told all they need is your procedures and they can work out the script from that and of course when I went to the procedures, I went - oh! I was embarrassed. I thought there’s no way I can give this to anyone.’ HeavyIndustry[2].

‘We were supposed to have a script where it would not have gone more than half an hour. What happened was a public relations person took the script then put in extra bits. And then the OH&S people added bits to make sure we had the right things spot on with what we're trying to say. What happened was at the very start all the information about the company itself as opposed to the OH&S content got out of hand so it's way too long. So an intro that should have been about a minute and a half maybe got dragged out.’ DiverseGoods[1].

A somewhat different problem arose with filming/video recording. The participants were sometimes unhappy with what the camera captured. In one instance reported by The Multimedia Company, the client complained that in the video (arranged and supervised by the client) half the people were shown not wearing their PPE (true), the forklift was rusty (true), the trucks did not have the correct branding (true) and the work practices were incorrect (true). Other participants reported:

‘If you don’t get it right, the little things stand out - someone in the screen shot is not wearing their PPE ...and sometimes until we get another chance to update that, it stays there. We did our first round of filming at one of our sites and we found that those work practices weren’t the ones we wanted to roll out, so we had to go back and review and hence, we’ve just done some more filming at a cost but to better capture the work practice that we want.’ Agriculture[1].

Services[1] used a dummy workstation set up for their inductions to show people what a workroom looked like because ‘If you have a look at the film you’ll see that in a real work room it looked pretty grey and dark and there was crap on the walls ...you don’t see it until you look at the visual and you think - oh no! ’

All equipment related problems (computers locking up, etc.) were resolved at the initial stages. In general, equipment was referred to in positive terms with DVD players and PCs being ubiquitous.

5.4.2 Actual Ease of Use

As discussed in Chapter 2.4.10, in this thesis we have the opportunity to examine the post-adoption PEOU. As shown in Figure 5-1 and illustrated by the following sample quotations from the interviews, a high percentage (87.5% (14/17)) found multimedia OHSR inductions easy or very easy to use (the difference being determined by the strength of the participants' response). Participant comments included:

'I'd be confused if somebody found it hard to use.' Utility[1].

'Easy? It's been certainly a bonus for us and it's improved, well the feedback we've had been more than positive.' Seaport[2].

'Ten times easier than what we were doing before.' Services[1].

'It's easier to control, it's easy to keep updated.' Mining[1].

'Very, very easy.' Agriculture[1].

The three participants who responded with neutral comments said 'It is probably too early to say.' HeavyIndustry[2], 'I don't find it a problem.' Services[2] and 'Straight forward provided it doesn't lock up.' Seaport[2].

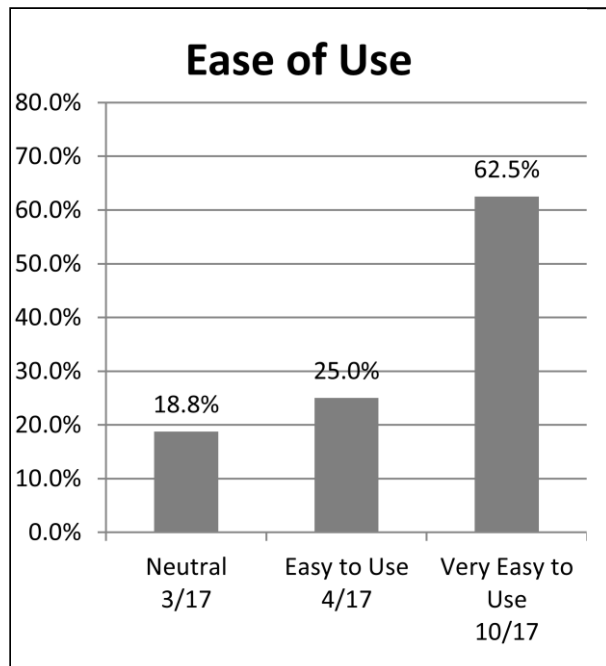


Figure 5-1 Ease of Use

While PU has consistently been a stronger predictor of usage than PEOU (Fox 2005; Chismar and Wiley-Patton 2003; Venkatesh and Davis 1996; Ma and Liu 2004), when dealing with a real-life technology such as multimedia, PEOU is qualitatively of interest. If, for all its other attributes, multimedia had been as difficult to use as say virtual reality, it is doubtful if it would have met the same acceptance (viz. the complete lack of virtual reality in OHSE applications).

5.4.3 Demonstratability

Over half of the participants (58.8% (10/17)) reported that just seeing the product demonstrated was enough to convince them to adopt it. This reaction is illustrated in the following sample quotations from the interviews:

‘I just saw it and it didn’t matter.’ Services[1].

The Multimedia Company came across and did a few presentations and so on and that was it. They could provide us with what we wanted.’ DiverseGoods[1].

‘Actually seeing the thing operating and having him run me through it is what sold me on that package.’ Seaport[3].

‘Once we saw that we knew that we could sort of adapt it to meet our requirements in the aviation industry.’ Airport[1].

5.4.4 Job Relevance

Nearly half of the participants identified Job Relevance as being an important factor in adoption (47.1% (9/17)). Typical comments from the interviews included:

‘Once we saw that we knew that we could sort of adapt it to meet our requirements in the aviation industry.’ Airport[1].

Yes it met our needs. The fact that then after that we could use existing content that they’ve got and then fiddle with it a bit and produce something that we wanted.’ DiverseGoods[1].

‘When we saw it we could see the enormous advantage of it, given that we at times used to do the verbal induction from the guide and people.’ Agriculture[2].

5.4.5 Output Quality

Over half of the participants identified the quality of the multimedia product as being an incentive to adopt (58.8% (11/17)) as illustrated by the following sample quotations from the interviews:

‘Other vendors didn’t have the ‘polish’ of The Multimedia Company product. They had input into the look and feel – very chuffed with it – the voice over is very, very good, very professional presentation and covers all the bases we need to cover.’ Seaport[3].

‘I had seen some others and they varied between adequate to dreadful. Theirs stood out as being leader of the pack. It didn’t lack anything. It was an absolutely lovely package.’ Seaport[2].

‘The quality in terms of the cleanliness of the presentations that they put to us, they were clean, they were easy to follow, they were simple to work, they contain simple messages with good images, in fact the images and the messages danced well. They were uncomplicated and they gave us a fairly good sense of a storyline that went through it, okay, so that was pretty important.’ Mining[2].

5.4.6 Demonstratability, Job Relevance, Output Quality and the ‘Herd’

Demonstratability, Job Relevance, Output Quality and examples of what others are doing (the ‘herd’ as identified in Chapter 5.3.2) are all factors that were assessed by the participants from sample inductions shown to them by The Multimedia Company.

Figure 5-2 illustrates the frequency of identification of the three TAM/TAM2 factors

with the ‘herd’ frequency shown for reference. If a participant identified more than one factor, a count was recorded for each factor frequency. As shown in Figure 5-2, the four factors were identified by the participants with nearly equal frequency.

In the context of assessing sample multimedia OHSE inductions, adoption factors may be inter-related – for example, a demonstration of a job relevant, high quality induction that illustrates what others are doing embodies all three TAM/TAM2 constructs and the ‘herd’. While shown as nearly equally frequent in Figure 5-2, the identification of factors often occurred in combinations. Was any one factor or combination of two factors more dominant in the combinations? Figure 5-3 shows the frequency of individual factors and factors in unique combinations that were identified by the participants. For example, two of the 17 participants identified Job Relevance as the exclusive, single factor while four identified the combination of Job Relevance and Demonstratability as the exclusive factors.

Comparing the frequencies in the two figures shows that while the factors were almost equally identified by count in Figure 5-2, in Figure 5-3 Output Quality was identified as the single, exclusive factor twice as often as either Job Relevance or Demonstratability. The combination of all three factors was identified as often as any single or combination of two factors. What may be gleaned from this suggests a combination of the three factors, dominated by Output Quality, provided the biggest incentive to adopt.

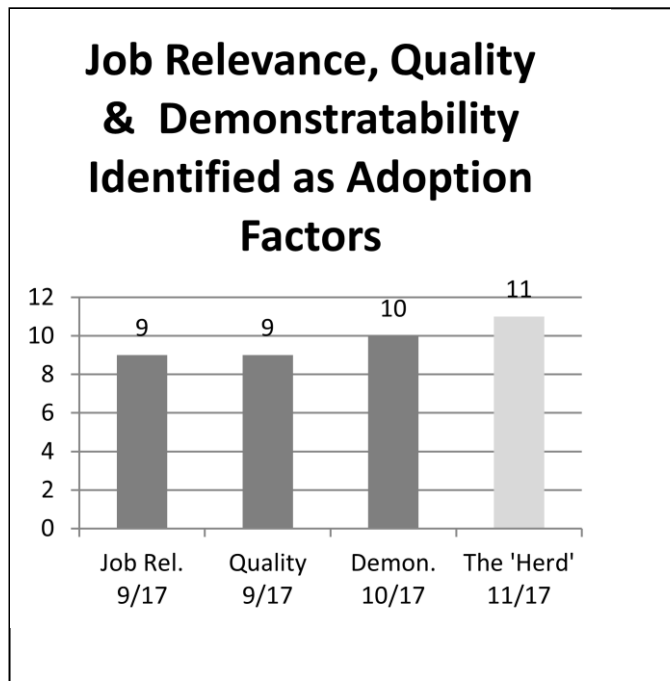


Figure 5-2 TAM/TAM2 Adoption Factors (1)

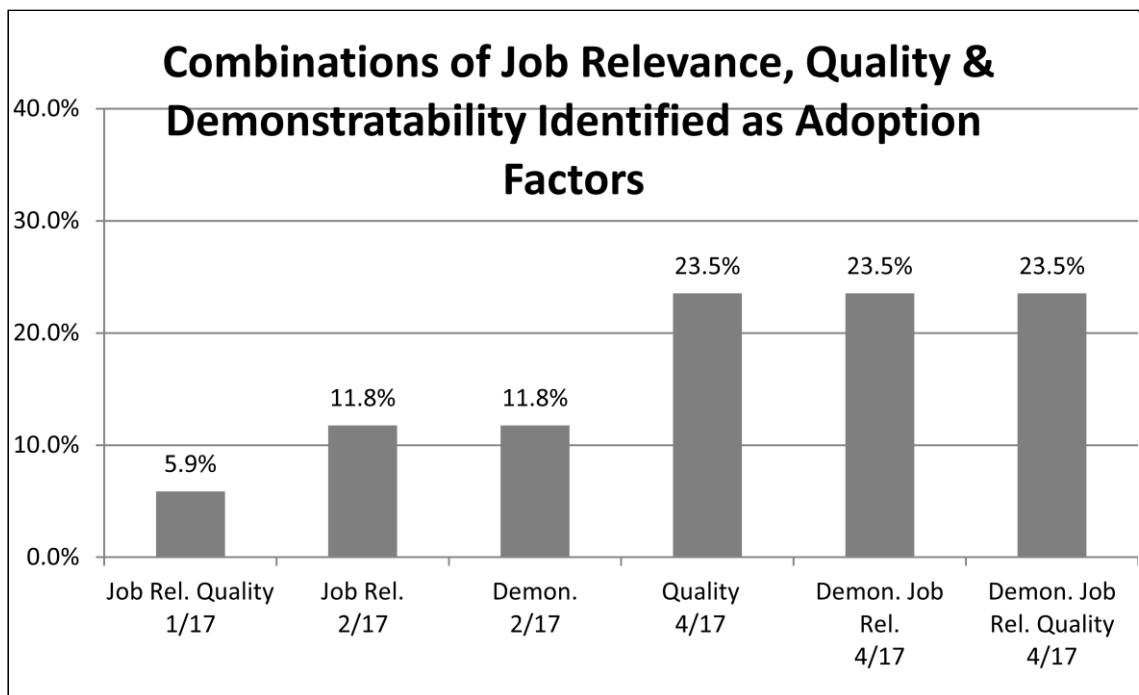


Figure 5-3 TAM/TAM2 Adoption Factors (2)

5.4.7 Subjective Norm

The Subjective Norm construct of the TAM2 posits a positive influence on the adoption of new technology via PU if the participants perceive their referents as being favourable (Hartwick and Barki 1994; Moore and Benbasat 1991; Venkatesh and Davis 2000). In an enterprise framework, this rationale may be extended to the concept of an ‘industry standard’ or ‘best practice’. From the responses in the interviews to questions concerning Subjective Norm, it was determined that the case study participants were not aware of any industry standards or best practice. Often, there were few or no peers to act as referents. Where possible referents existed, either within or outside their industry sector, the participants were generally unaware of what the possible referents were doing in the realm of multimedia for OHSE inductions. Further, when shown samples of possible referent inductions, the participants were unconcerned with the opinions of the companies from which the samples were drawn.

Subjective Norm was therefore not found to be a factor influencing adoption of multimedia OHSE inductions.

Venkatesh and Davis (2000) and Hartwick and Barki (1994) also identified the relationship between voluntariness (in this case DOC legislation) and Subjective Norm. As shown in Figure 2-5, Subjective Norm has both a direct and indirect (via PU) effect on intention to adopt. The direct effect is moderated by voluntariness and is only present when the system use is perceived to be mandatory and diminishes with time and experience. The indirect effect via PU is not moderated by voluntariness. The existence of real or implied legislative requirements to exercise a DOC includes the provision of

OHSE inductions. Therefore in a mandatory situation, Subjective Norm ought to be a factor in adoption. A large proportion (76.9% (10/13)) of the participants acknowledged that industrial legislation was involved in their decision to have OHSE inductions. However, they pointed out that industrial laws do not specify the manner of the induction. The adopters therefore viewed the requirement for the provision of inductions as mandatory but the use of multimedia as voluntary. Please see Chapter 5.6 for a further discussion.

5.4.8 Image

Ajzen and Fishbein (1980) in conjunction with Moore and Benbasat (1991) identify Image as a factor in acceptance and Moore and Benbasat (1991, p. 195) define Image as ‘the degree to which use of an innovation is perceived to enhance one’s ... status in one’s social system.’. Venkatesh and Davis (2000) have shown that Image is a significant influence in adoption but that it has only half the impact on the variance of PU as Subjective Norm. As shown by the participants’ comments below, the above definition of Image and its influence is shown by this study to apply equally as well to enterprises as individuals. Eleven participants voiced opinions concerning image – two said image was not a factor and nine (72.7% (9/11)) reported image as a positive factor in adoption as illustrated by the following sample quotations:

‘It’s good for the company’s image because it’s a better and clearer method of passing on information to show how leading edge our company is.’ Services[2].

‘Multimedia set us up as a benchmark leaders in our field’ Services[1].

‘In the early days it was kind of leading edge and novel to be doing this stuff when no one else was. Selling the business and trying to get a new image, being at the lead edge of IT - which is kind of romantic.’ Construction[1].

‘There was no branding, there was no consistency in language and image, so what we were after also was that reflection of a professional image to our I suppose customers or vendors, suppliers ...’ Heavy Industry[1].

5.4.9 Future Adoption

If, as Kaul and Rao (1995) predicted, users select systems that provide maximum utility, then that utility is moderated by the TAM/TAM2 factors of Subjective Norm, Image, Job Relevance, Output Quality of Output and Result Demonstratability (Venkatesh and Davis 2000). Given the high levels of the TAM/TAM2 factors (excluding Subject Norm) reported by the participants, the efficacy of the TAM/TAM2 should therefore be evident in their intention for future adoption. Davis (1989) was the first to make this connection. Almost half (47.1% (8/17)) of the participants indicated their intention to adopt additional multimedia OHSE inductions in the near future. The other half was either content with or still evaluating the utility of their current inductions. None of the participants had plans to replace their multimedia OHSE inductions with other products. Sample quotations from the interviews illustrating future plans include:

‘Now what I’ve been asked by the Executive General Manager is to adopt it to a national model.’ Services[1] .

‘That’s convinced me to do more projects. We’ve been asked to move everything to multimedia.’ Mining[1].

‘A few of the managers are really, really, impressed with what we’ve done and are looking forward to seeing this evolve in the web phase.’ Agriculture[2].

‘Currently talking to [The Multimedia Company] about putting our one on line because we have four sites ...’. HeavyIndustry[1].

5.4.10 The Technology Acceptance Model Theoretical Outcomes Summary

In response to the research questions:

Q4.1 To what extent have multimedia OHSE inductions been easy to use?

Q4.2 In what ways and to what extent have Subjective Norm, Image, Job Relevance, Output Quality and Demonstratability been influences in the adoption of multimedia OHSE inductions?

Q4.3 What is the intent for future adoption of multimedia OHSE inductions?

the anticipated and actual outcomes of the research as discussed in the preceding sections are summarised in Table 5-4.

Table 5-4 TAM/TAM2 Theoretical Outcomes

Adoption Theory	Anticipated Theoretical Outcomes	Conclusions
Negative Usefulness	As discussed in Chapter 5.4.1, negative usefulness is not a theoretical issue but is included here as being related to PU/actual usage with data derived from the interviews	Scripting and filming identified as potential problem areas Lack of multimedia capable equipment was not a problem
TAM/TAM2 - Perceived Ease of Use	PEOU will be an influence in intention for future adoption (Davis 1989; Davis, Bagozzi, and Warshaw 1989)	Supported – i) multimedia OHSE inductions were found to be easy to use, ii) the majority of the participants planned future adoption
TAM/TAM2 - Subjective Norm	Subjective Norm via PU will be a factor in adoption DOC legislation will cause Subjective Norm to be a direct factor in adoption (Hartwick and Barki 1994; Moore and Benbasat 1991; Venkatesh and Davis 2000)	Not supported – no referents consulted Not supported - inductions are mandatory but use of multimedia inductions is optional
TAM/TAM2 – Image	Multimedia was adopted because it enhanced company image (Ajzen and Fishbein 1980; Moore and Benbasat 1991; Venkatesh and Davis 2000)	Supported

5.5 MEDIA RICHNESS THEORETICAL OUTCOMES

The research question related to MR theory asks:

Q5.0: In what ways and in what manner is multimedia better able to dispel uncertainty and reduce equivocality as compared to face-to-face delivery of OHSE inductions?

As reported in Chapter 2.9, the anticipated theoretical outcome for MRT proposes that face-to-face presentation is the richest media and the best method of dispelling uncertainty and reducing equivocality (Daft and Lengel 1987; Webster and Trevino 1995; D'Ambra 1995; Webster, Trevino, and Stein 1996; Vickery et al. 2004; Caspi and Gorsky 2005).

According to Weick (1976), organisations collect and process data to reduce uncertainty. Daft and Lengel (1986) take this a step further and state that organisations train to dispel uncertainty and reduce equivocality. Uncertainty can be dispelled with the addition of further information, equivocality cannot (please see Chapter 2.5.1 for a full discussion of the differences). In an attempt to dispel uncertainty and reduce equivocality, organisations make rules which are passed on to the employees as the content of training (Weick 1979). The reduction of uncertainty and equivocality are therefore at the root of OHSE inductions.

The adopters in this research moved away from traditional face-to-face OHSE inductions to multimedia. A large percentage of the adopters (73.3% (11/15)) reported that they chose multimedia over face-to-face presentation because it offered the best opportunity to dispel uncertainty and reduce equivocality by delivering consistent, accurate and unequivocal information. The following sample quotations from the interviews illustrate this sentiment:

‘For the most part by having this group induction CD at least we can be assured of consistency. And by the same token, we wanted to get specific information

out and we don't want it to deviate or be different. We wanted that consistency and for that reason, this was perfect. DiverseGoods[1].

‘Rather than being verbally delivered by different employees, we basically get a standard induction - everyone is getting told the same messages.’ Agriculture[2].

‘We certainly established a lot more consistency and I think the overall sort of impact is professional and effective. Consistency was an issue and not just in one region, but across all regions.’ Construction[1].

‘I think the main thing is to ensure everyone got the same information.’ Mining[1].

‘I believe that the consistency of what we’re delivering is far improved. I know that clearly how I felt in the morning when I was doing that induction is how it got delivered. So even if I’m the one doing the induction every time, there’s no real consistency.’ HeavyIndustry[2].

Face-to-face training was not entirely abolished. Where the amount of information was small or the subject was local, traditional inductions were retained. For example, pointing out the emergency exits before the start of a meeting or an often paper based induction when workers or visitors arrived at a new work location.

In response to the research question

Q5.0: In what ways and in what manner is multimedia better able to dispel uncertainty and reduce equivocality as compared to face-to-face delivery of OHSE inductions?

the anticipated and actual outcomes of the research as discussed in the preceding section are summarised in Table 5-5.

Table 5-5 Media Richness Theoretical Outcome

Adoption Theory	Anticipated Theoretical Outcomes	Conclusion
Media Richness Theory – Equivocality and Uncertainty	Face-to-face presentation is the richest media and the best method of dispelling uncertainty and reducing equivocality (Daft and Lengel 1987; Webster and Trevino 1995; D'Ambra 1995; Webster, Trevino, and Stein 1996; Vickery et al. 2004; Caspi and Gorsky 2005)	Not supported – multimedia seen as superior in dispelling uncertainty and reducing equivocality

5.6 LEGISLATIVE DUTY OF CARE FINDINGS

The research question relating to legislative DOC asks:

Q6.0: In what ways and to what extent has DOC been a factor in the adoption of multimedia OHSE inductions?

DOC as a voluntariness factor in the effect of Subjective Norm on adoption was discussed in Chapter 5.4.7. This section considers DOC as a direct, legal factor for which there were no anticipated theoretical outcomes.

A number of aspects of DOC arose in the interviews. DOC as a company responsibility (by legislation or not) was taken extremely seriously by all the participants. At least three of the participants had had deaths in the workplace in the two years preceding the interviews. DOC as an environmental legislative requirement was mentioned by eight of the participants. This section of the thesis only investigates multimedia OHSE inductions as they may relate to meeting legislative requirements or providing a tool for insurance investigations.

New South Wales is the only Australian state enforcing OHSE inductions by specific legislation. OHSE professionals in the other states of Australia have a general view that OHSE inductions are part of the complete DOC package. For this reason, DOC legislation was not perceived as being an influence on the adoption of multimedia OHSE inductions in particular as any induction methodology would satisfy the specific or implied legal requirements.

The pros and cons of participant attitudes towards DOC legislation may be summarised by the following sample comments in response to the question ‘Has mandatory legislation been a factor in adoption of multimedia?’:

‘Well obviously we’ve got a duty of care to ensure that our staff are aware of our policies and procedures, and by making sure it was in a format that was attractive to the viewer. Then we could basically say, ‘Well yep, we know that they’re doing it’. But if we sat somebody down and gave them a procedure and asked them to read it for half an hour, I’m sure they’d go ‘Yep, yep. Read it. Done’ when they probably haven’t.’ Utility[1].

‘Duty of care not only in the safety legislation but secondly it covered a whole bunch of other areas. For example, we include the environmental requirement, so we introduce people to our environmental standards, environmental stewardship, our heritage, what’s critical about the heritage factors in our mine sites, rail, and port that we’re on other people’s land. There are artefacts there. We can show things [using multimedia] that they can’t see ordinarily and so that prepares them for how they move around the place. So duty of care beyond just the safety, duty of care as a corporate citizen.’ Mining[2].

‘I’d have to say yes because put simply, mentioning the history [a workplace fatality] there’s the CEO and the Board of Directors straight away. In some of the cases, it still hasn’t gone to court yet. So their duty of care came into it and so for that reason there’s a number of these things that we had to do. So this sort of thing basically stemmed all the way from the top down.’ [not identified for legal reasons].

‘I mean we have a duty of care on the site, and we would discharge that duty in other ways if multimedia wasn’t available. So we would find ways of providing instruction and training to people prior to coming on to site.’ HeavyIndustry[1].

In the formal/legal investigation of industrial accidents and incidents, the role of competency assessments in documenting DOC was highlighted by 60% (9/15) of the participants as being an important and positive use of multimedia in the following manner: when an industrial accident occurs, the investigating authority often requires the company to produce evidence of how they have carried out their duty. By showing

the content of the multimedia induction, demonstrating the interactive quiz facility (which for every incorrect answer takes the user back to review the source material) and the record of the inductee having passed the quiz, the company can demonstrate that it has carried out its DOC. A classic case of this was related by one of the participants:

‘I had a lady once that did the induction with me one on one. She decided to get up and take some curtains down - gets up on a table that is next to the window with her socks on. I had already issued ladders to that site because they had issues with the curtains. She slides off the table, gashes her leg, off to hospital, stitches in her leg. I denied the insurance claim. I said nope - you knew better, you had a ladder, you knew you were not supposed to, blah blah blah. I went to court and I lost the claim. I could prove that I had inducted her. I couldn’t prove the content of the induction even though I had the book. If she did that now with the induction that I have, there is a specific part of induction that shows people you are not to stand on a desk and clean.’ [edited and participant’s name deleted to maintain confidentiality].

In response to the research question:

Q6.0: In what ways and to what extent has DOC been a factor in the adoption of multimedia OHSE inductions?

it was found that DOC legislation was not perceived as being an involuntary influence on the adoption of multimedia OHSE inductions as an induction delivered with any methodology would satisfy the specific or implied legal requirements. Multimedia OHSE inductions may play a beneficial role in safety incident investigations where the level of DOC provided by a company needs to be demonstrated.

5.7 PRODUCTIVITY-PROFITABILITY PARADOX

THEORETICAL OUTCOMES

The research questions related to the PPP asks:

Q7.0 Does the adoption of multimedia OHSE inductions support or refute the PPP?

Sub-questions:

Q7.1 Have multimedia OHSE inductions been cost effective? How has this been determined?

Q7.2 Has multimedia affected the efficiency of inductions?

Q7.3 Were ‘profits’ traded away before hitting the bottom line?

As reported in Chapter 2.9, the anticipated theoretical outcomes for PPP propositions that could be tested in this thesis include:

- Investment in multimedia will not be cost effective (Quinn and Baily 1994; Burge 2000; Cassidy 2000; Fahy 2004)
- Investment in multimedia may prove to be disruptive or counterproductive (Murgatroyd 1992; Laudon, Traver, and Laudon 1996; Fernandez 1997; Evans 1998; Fahy 2000; Dalal 2001; Fahy 2004)
- Investment in multimedia has no prospect of ever providing a ROI (Oberlin 1996; Welsch 2002; Black and Lynch 1996)
- Multimedia as a form of IT will improve the efficiency of inductions (Strassmann 2004d, 2001a, 2004b, 2004c)

- 'Profits' from investment in IT may be traded away before they reach the bottom line (Brynjolfsson and Hitt 1993; Hayward, Magrassi, and Roberts 2002).

As discussed in Chapter 2.7.4, when examining the commercial aspects of IT in general and multimedia as employed in OHSE inductions in particular, there are three distinct but related aspects: cost effectiveness, efficiency and profitability. The interviews addressed all three aspects. As the interviews progressed, it was found that while the case study participants were acutely aware of cost effectiveness (getting the job done at a cost) and efficiency (getting more of the job done more quickly), they were far less aware of profitability. This appeared to be part of the OHSE culture – what price does one put on avoiding an accident or saving a life? The OHSE departments were not considered by the case study participants to be 'profit centres' because the only metrics for the groups' performance were related to accident and death statistics (not available to the researcher). As discussed in Chapter 1.9, the costs of the inductions were not available, the participants were not asked about nor did the volunteer any direct cost data. Therefore, rather than addressing enterprise profitability, the questions concerning cost effectiveness and profitability were directed towards the section's costs and budget.

5.7.1 Cost Effectiveness

According to the literature, the prospect for multimedia attaining cost effectiveness is bleak - many sources maintain that multimedia is unlikely to initially, or ever save the enterprise time or money (Quinn and Baily 1994; Burge 2000; Cassidy 2000; Fahy 2004) and may even in the short term cause chaos, promote time-wasting and lower productivity (Murgatroyd 1992; Laudon, Traver, and Laudon 1996; Fernandez 1997; Evans 1998; Fahy 2000; Dalal 2001; Fahy 2004). Further, it was claimed that the total

cost of ownership of multimedia may be many times the purchase price and will constantly rise with little or no prospect of recouping costs (Oberlin 1996; Welsch 2002; Black and Lynch 1996).

In contrast to this outlook, Figure 5-4 shows that 82.4% (14/17) of the participants found multimedia OHSE inductions to be cost effective or very cost effective (the difference being determined by the strength of the participants' response). The three not reporting cost effectiveness said either they did not know or it was too soon to tell. None of the participants reported multimedia for OHSE inductions had a negative ROI.

Using multimedia, the participants were able to eliminate or severely reduce the basic elements of the traditional induction model – the trainer, the training material, the training room and the training schedule. None of the participants had conducted any formal cost analysis and were content with 'back of the envelope' or simple time multiplied by cost calculations to support their view of cost effectiveness. This may either be interpreted as a lack of due diligence on their part or, more likely, the cost effectiveness was extremely obvious. This latter conclusion is supported by the time spans for ROI in the participant's comments which varied from having 'already paid for itself' to 18-24 months.

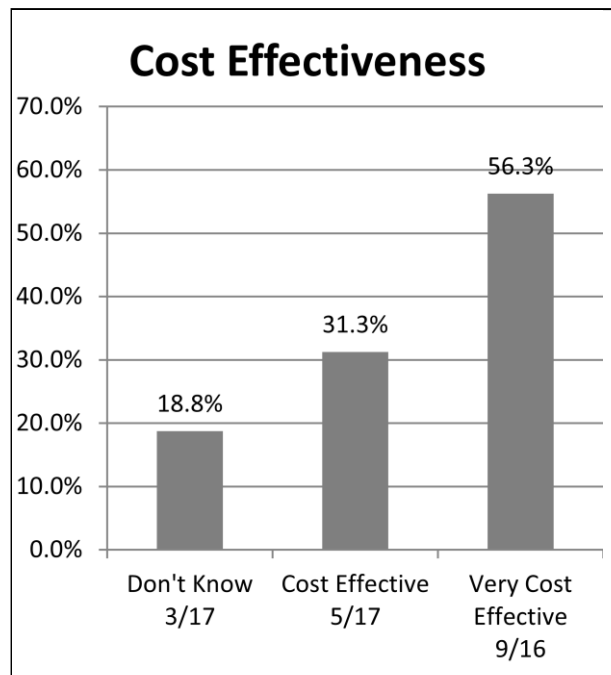


Figure 5-4 Cost Effectiveness

Comments related to cost effectiveness included:

‘Cost effective? Yes, yep, definitely. We’ve spun our calculation on that particular issue. You know you might get 20/30 people going through an induction. Time taken to do that would be the time saving, so 40 minutes. It can be a daily type thing, just a time thing. So you multiply that out by the ways and it’s amazing like I said - the return is there.’ Construction[2].

‘In the whole scheme of things with the amount of money that has been put into this and the fact that when we worked it out in terms of what the cost is per employee, we’ve got over 2,500 staff, so when we actually put it in dollar terms of duty of care per person, it’s nothing. For that reason it was easy getting this across the line in terms of costs, basically the cost benefit ratio was correct and it was excellent.’ DiverseGoods[1].

‘Certainly from a cost point of view the induction is reducing the time it’s taken to do those inductions. Paying casual staff to sit around for four hours and now we’re paying them for one hour - yes, it has been cost effective. [How do you know?] Back of the envelope type stuff, it pays itself back quickly. If it saves two hours we induct say 800 people a year, that saves two years at \$20/hr, you know, the payback period is probably 1-2 years.’ Agriculture[1].

‘Let me think - we did the sums on this. I think we’ve estimated we’ll get our return on investment in around 18 months and I think I’ve spent \$100,000 on this.’ HeavyIndustry[2].

‘It has probably been very, very cost effective as far as we are concerned. We haven’t actually measured that to be quite honest, but I would think off the top of my head that it would be cost effective. I mean, just from the basis that we no longer require a person to conduct the site induction and there doesn’t need to be a physical presence. So considering we run those inductions pretty much on a daily basis at a large number of sites that’s a lot of inductions.’ Construction[1].

‘Very cost effective. It’s definitely cost productive, because the person can view the DVD on their own. They don’t need somebody to run through it with them. I can’t tell you the benefits monetary wise now, but looking at the long term ... it’s been very well received so that’s already a sign it’s paid for itself.’ Utility[1].

5.7.2 Efficiency

The Information Productivity®/efficiency alternative to the PPP emerged in 2004 in a series of articles by Strassmann (2004b, 2004c, 2004d). He formulated his lifetime investigation of the PPP based on thousands of measurements into a set of ‘laws’ – i) IT spending and profitability are unrelated, ii) profit comes from low cost transactions, iii) IT spending is directed towards reducing transaction costs, iv) transaction costs are unique to the firm and the correct level of IT spending cannot be derived from public data (hence the inability to prove/disprove the PPP from economic statistics), and v) competitive tensions of gain/loss cause firms to exploit every conceivable advantage of IT. No papers have appeared that have made a major impact on these findings.

All of the participants 100% (17/17) reported that the use of multimedia OHSE inductions increased the induction efficiency. The pivotal factor in efficiency was time – more inductions in less time equals higher efficiency. The Multimedia Company uses the term ‘Multimedia Time’ – meaning the reduction in time that can be achieved when converting existing slide show or video inductions into multimedia. The factor generally used is four to one – four hours of other media may be reduced to one hour of multimedia. Support for increased time efficiency was first provided by Fletcher (1990) who found time savings of between 35-45%. These findings were confirmed by a number of later studies (Adams 1992; Cantwell 1993; Hofstetter 1994). Both Hall (1995) and Hemphill (1997) found reductions in time as compared to instructor based training in the range of 20-80% with the mode being 40-60%.

Participant support for the increased efficiency provided by multimedia OHSE inductions is illustrated by the following sample quotations from the interviews:

‘It significantly reduced the time that it took to get information across. It went from four hours down to less than an hour to do the induction. So that certainly reduced the time.’ Agriculture[1].

‘So it’s certainly more efficient. We’re terribly happy in that anyway. If they’re more efficient in doing the induction they can get out to the site and spend a bit more time on site than in the induction room.’ Construction[2].

‘With questions it rarely goes over 40 minutes, so it is very time effective. [The old one] could take, you know, any amount of time from that time to an hour and a half.’ Utility[1].

5.7.3 Redistribution of ‘Profits’

The question of the productivity-profitability of IT investment was first publicly raised by Solow’s now famous observation that ‘You can see the computer age everywhere but in the productivity statistics.’ (Solow 1987, p. 36). Many efforts of the next two decades failed to put this proposition to rest. Brynjolfsson and his associates were one of the few research groups during that period proposing that IT did actually provide productivity-profitability gains (Brynjolfsson 1993; Brynjolfsson and Hitt 1993, 1996, 1998; Brynjolfsson, Hitt, and Yang 2002; Brynjolfsson 2003; Brynjolfsson and Hitt 2003). Other researchers including Osei-Bryson and Ko (2004), Lin and Shai (2006), Lin and Lin (2006) were not able to duplicate the gains detected by Brynjolfsson’s group. As the

years progressed and the productivity failed to materialise, even Brynjolfsson started to steer away from absolute profitability.

The explanation that the PPP might be caused by a redistribution of the gains achieved from the use of IT was introduced by Brynjolfsson (1993). The idea was that ‘profits’ may be traded away in some manner before they hit the bottom line – for example in price reductions, lower stock levels or other customer or private benefits (Hayward, Magrassi, and Roberts 2002). A similar explanation centred around the concept that the introduction of IT created ‘organisational slack’ with the benefits going to the workload and demands upon staff (Brynjolfsson 1993; Brynjolfsson and Hitt 1996; Dehning, Dow, and Stratopoulos 2003).

Supporting the PPP solution that profits are traded away before reaching the ‘bottom line’, 93.3% (14/15) of the participants reported that significant financial benefits were realised from the use of multimedia for OHSE inductions that did not necessarily hit the ‘bottom line’. When the participants were asked if the cost savings meant that their budget for the next year would be reduced, after the initial laughter, none indicated that there would be a reduction.

The cost benefits identified by the participants were related to training resource – especially trainer time (including their own) - that could now be used for duties more aligned with their training and position statements as demonstrated by the following samples comments from the interviews:

‘Well our department is under resourced so it’s probably allowed our staff to do other work. Also it means that our resource aren’t tied up running around the country delivering this safety induction [So this will release some of your more senior people to do other activities?] Absolutely, absolutely.’ Agriculture[2].

‘Online training is now freed up our training room so we can utilise it for other training that we may require.’ Airport[1].

‘Yeah, certainly, that is the biggest benefit for me that I don’t need to focus on inductions. A supervisor can run these in his/her own induction. I think that the bottom line thing hasn’t been lost on the port. I’m sure that’s been hammered home fairly, fairly significantly.’ Seaport[1].

‘We’ve now got time to do other things and things that we’re being paid to do. We’re not taking the environmental officer, or the shipping superintendent away from what they’re doing so that they can go and spend two hours every day doing an induction. So those two hours then is gone back into the job. So it’s an investment back into the job.’ Seaport[3].

5.7.4 Profitability-Productivity Paradox Thematic Outcomes Summary

In response to the research questions:

Q7.0 Does the adoption of multimedia OHSE inductions support or refute the PPP?

Sub-questions:

Q7.1 Have multimedia OHSE inductions been cost effective? How has this been determined?

Q7.2 Has multimedia affected the efficiency of inductions?

Q7.3 Were ‘profits’ traded away before hitting the bottom line?

the anticipated and actual outcomes of the research as discussed in the preceding sections are summarised in Table 5-6. The major finding was that the PPP proposition was both refuted and supported – in this instance, IT in general and multimedia in particular were found to be cost effective but the ‘profit’ was traded away before it hit the bottom line.

5.8 PARADIGM SHIFT THEMATIC OUTCOMES

The research question relating to paradigm shifts asks:

Q8.0 Has the change to multimedia OHSE inductions been viewed as revolutionary? If so, what factors proved powerful enough to cause the firm to ‘take the leap’?

As reported in Chapter 2.9, the anticipated theoretical outcomes relating to paradigm shifts include:

- The paradigm shift will be revolutionary, the new paradigm will reign supreme, there will be no mixing of the old and new paradigms and the change will be sudden and unstructured (Kuhn 1962/1970)

Table 5-6 PPP Theoretical Outcomes

Post Adoption Theory	Anticipated Theoretical Outcomes	Conclusions
PPP: Cost Effectiveness	<p>Investment in multimedia will not be cost effective (Quinn and Baily 1994; Burge 2000; Cassidy 2000; Fahy 2004)</p> <p>Investment in IT may prove to be counterproductive (Murgatroyd 1992; Laudon, Traver, and Laudon 1996; Fernandez 1997; Evans 1998; Fahy 2000; Dalal 2001; Fahy 2004)</p> <p>The total cost of ownership of investment in multimedia has no prospect of ever providing a ROI (Oberlin 1996; Welsch 2002; Black and Lynch 1996)</p>	<p>Not supported – found to be very cost effective</p> <p>Not supported – no evidence of negative usefulness in operation</p> <p>Not supported – short term ROI indicated</p>
PPP: Transaction Efficiency	<p>Multimedia will improve the efficiency of inductions (Strassmann 2004d, 2001a, 2004b, 2004c)</p>	Supported – more inductions in less time
PPP: Profit Traded Away	<p>Investment in IT will not improve productivity-profitability (Triplett 1999; Dedrick, Gurbaxani, and Kraemer 2003; Melville, Kraemer, and Gurbaxani 2004; Ahituv and Greenstein 2005; Byrd et al. 2006; Ross and Ernstberger 2006)</p> <p>'Profits' from investment in IT may be traded away before they reach the bottom line (the 'Redistribution' explanation) (Brynjolfsson and Hitt 1993; Hayward, Magrassi, and Roberts 2002)</p>	<p>Supported – departmental budgets not reduced</p> <p>Supported – personnel released for more other duties</p>

- The paradigm shift will be caused by a disruptive technology (Anderson and Tushman 1990; Bower and Christensen 1995; Christensen 2007)
- There must have been powerful incentives for enterprises to 'make the leap' (Von Hippel 1986; Moore 1991).

If the adoption was viewed as revolutionary, this research targets the usages and applications that were compelling enough to encourage the adopter to 'make the leap'.

5.8.1 Evolutionary vs. Revolutionary

Figure 5-5 illustrates the distribution of the participants' views of the evolutionary vs. revolutionary nature of the paradigm shift. While 50.0% (8/16) saw it as purely revolutionary, nearly half saw it containing elements of evolution. For those viewing the change as revolutionary, the only common inducements to 'take the leap' were efficiency 18.8% (3/16) and image 18.8% (3/16).

Including both evolutionary and revolutionary views, nine different reasons as listed in Table 5-7 were given for being induced to take the leap. While these reasons include efficiency, Image and Output Quality, they also include a diverse range of reasons that are somewhat at odds with the marketing and TAM/TAM2 factors/forces. This might suggest that the rationale for taking a revolutionary leap may overlap or differ from the rationale for technical adoption.

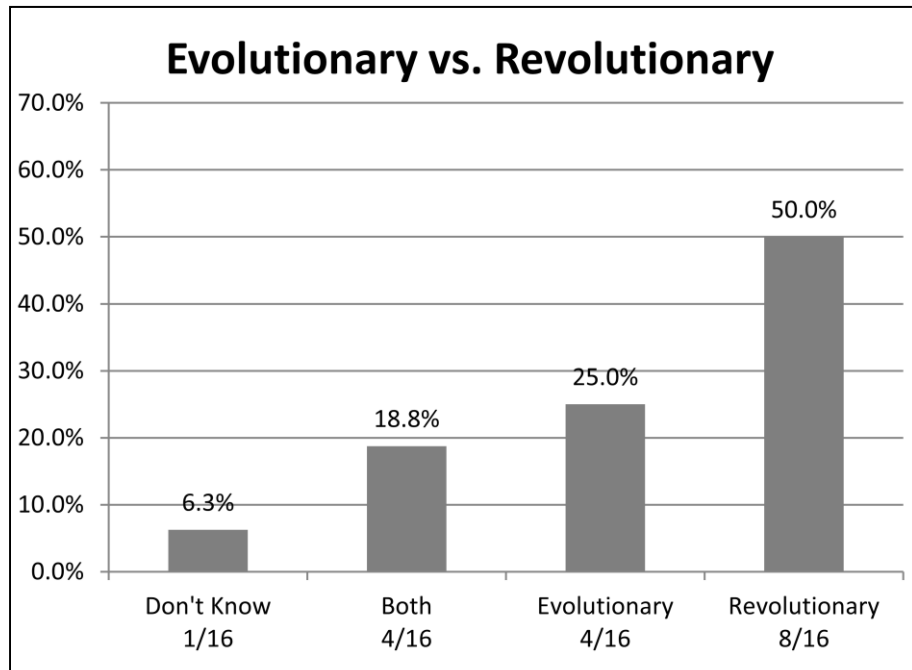


Figure 5-5 Evolutionary vs. Revolutionary

Table 5-7 Inducement to ‘take the leap’

Inducement to ‘take the leap’	Number
Efficiency	4
Image	3
Output Quality	2
Anyone can access	2
Keep trade unions out	1
Consistency	1
Updatability	1
Equity and Diversity	1
Deaths in the workplace	1

5.8.2 Paradigm Shift

In a paradigm shift, it is predicted that the old paradigm will be completely replaced by the new paradigm (Kuhn 1962/1970). All new inductions planned by the participants will be in the multimedia format – many of them planning to move from CD-ROM to on-line. However, the older paradigms of slide shows and written documents have not been totally displaced. It was reported that these methods would continue to be used for small local or area inductions. An inductee may sit for a general company multimedia OHSE induction, then perhaps a multimedia site induction followed by a slide show or paper based location induction (fire extinguishers, evacuation procedures, etc.). This mix of paradigms is not likely to disappear as the small, local inductions, lasting only a few minutes, could not be cost effectively produced in multimedia.

It was also predicted that the transition in paradigm shifts would be rapid and unstructured (Kuhn 1962/1970). As reported by all case study participants, the shift to multimedia was sudden – one day it was a slide show induction, the next a group mode or self-paced multimedia induction on a PC or DVD player. However, the shift was not unstructured. There were no reported instances of confusion or disorganisation.

5.8.3 Disruptive Technology

Anderson and Tushman (1990), Bower and Christensen (1995) and Christensen (2007) identified disruptive technologies and predicted two distinctive scenarios – a lower level, lower cost replacement for a portion of a higher cost technology, or a new, high cost, higher capability technology targeted towards a select high end market.

The multimedia OHSE induction paradigm shift does not match either of these scenarios. The technology (multimedia) was not a lower cost replacement for a higher cost technology - although video was considered by users to be higher cost technology, low cost slide shows were used almost exclusively. Multimedia was not a high cost technology aimed at a select high end market. Multimedia as used in OHSE inductions did not match either of these criteria and therefore may not be considered a disruptive technology.

5.8.4 Paradigm Shift Theoretical Outcomes Summary

In response to the research question:

Q8.0 Has the change to multimedia OHSE inductions been viewed as revolutionary? If so, what factors proved powerful enough to cause the firm to ‘take the leap’?

the anticipated and actual outcomes of the research as discussed in the preceding sections are summarised in Table 5-8.

Table 5-8 Paradigm Shift Theoretical Outcomes

Post Adoption Theory	Anticipated Theoretical Outcomes	Conclusions
Paradigm Shift Evolutionary Revolutionary	<p>The paradigm shift will be revolutionary - the new paradigm will reign supreme,</p> <p>There will be no mixing of paradigms</p> <p>The change will be sudden and unstructured</p> <p>(Kuhn 1962/1970)</p>	<p>Supported</p> <p>Not fully supported – face to face inductions retained for minor inductions</p> <p>Sudden - supported</p> <p>Unstructured – not supported</p>
Paradigm Shift Disruptive Technology	<p>The paradigm shift will be caused by either a lower level, lower cost replacement of a higher cost technology, or a new, high cost, higher capability technology targeted towards a select high end market.</p> <p>(Anderson and Tushman 1990; Bower and Christensen 1995; Christensen 2007)</p>	<p>Not supported – neither scenario was applicable</p>
Paradigm Shift Incentives	<p>There must have been powerful incentives to 'make the leap'</p> <p>(Von Hippel 1986; Moore 1991)</p>	<p>Supported – but diverse incentives that generally do not match marketing or adoption factors/forces</p>

5.9 UNANTICIPATED THEMES

A number of unanticipated findings and themes arose from the investigation of the practice-oriented data and the thematic analysis of the case study interviews. These are listed in Table 5-9 and discussed in the following sections.

Table 5-9 Unanticipated Themes

Theoretical Area	Aspect	Un-Anticipated Themes
Paradigm Shift	Revolutionary Technology	Repertoire of multimedia techniques reduced over time
PPP TAM/TAM2	Usefulness and Cost Effectiveness	Significant savings in self insurance
PPP TAM/TAM2	Usefulness and Cost Effectiveness	Assistance winning tenders
TAM/TAM2	Quality Management	Assistance with ISO and Quality Management Audits
TAM/TAM2	Usefulness	Additional Languages

5.9.1 Decline of Multimedia Repertoire

The data in Table 5-10 compares the employment of multimedia techniques as shown in Table 4-11 to those derived from a study of 67 multimedia projects produced for other clients by The Multimedia Company in 2002-2005 as part of the author's MSc. Research (Wright 2005). A decline in repertoire can be clearly seen as The Multimedia Company concentrated more on site specific OHSE inductions. The reason for this decline is not clear and may reflect a change of focus by The Multimedia Company away from 'wow factor' techniques needed to promote and obtain early sales to more pragmatic use of multimedia designer time in routine production of inductions.

5.9.2 Self-Insurance Cost Savings and Commercial Advantage in Tenders

While the cost effectiveness of multimedia OHSE inductions in operational terms (delivery) was widely reported by the case study participants, Services [1] reported two

Table 5-10 2005 versus 2009 Employment of Multimedia Techniques

Multimedia Technique	2009 Percent Change from 2005
Text and Bullet Points	Up 36%
Still Photos with Transitions	Up 37%
Still Photos with Panning	Up 19%
2D Graphics	Up 43%
2D Graphics Animated	Up 15%
3D Graphics	Down 5%
3D Graphics Animated	Down 17%
3D Fly-thru	Down 17%
Full Motion Human Figure	Down 1%
Video	Up 10%
Blue Screen	Up 3%

unanticipated, indirect, commercial advantages provided by multimedia. The enterprise is a self-insuring company. The use of OHSE multimedia inductions and recorded competency assessments had a direct bearing on the cost of OHSE claims and associated insurance costs. Since the introduction of OHSE multimedia inductions, the cost of claims had dropped to one third of its previous value and the insurance premium percentage had dropped by half. The following quotation from the interviews reflects this theme:

‘From the inception of the visual induction you can see a dramatic decrease in claims and costs and additionally the decrease in premiums due the better quality trained staff being placed on sites which also helped awareness and in turn reporting to therefore manage the issues. I truly believe the visual package they

watch and listen to shows them what not to do, and they are much more aware again reducing our exposure to risk. The biggest impact to the company is the cost of premiums reduced by a million dollars, and the cost of claims accordingly.’

Services[1] also reported that because they were able to demonstrate the high level of DOC provided by the OHSE multimedia inductions, they were able to gain a commercial advantage over their opposition in competitive tendering:

‘One aspect you could look at is that when we win tenders and contracts as a company because of our structure now with that induction. An example would be the largest single story building in the city - \$1,500,000.00 a year or maybe more. The entire board of that building that sat on the process of awarding the contract came in here and we put them through our structure of recruitment and inductions. They were extremely impressed and actually told a rival company that the reason we won it was because of our recruitment structure and induction. So you can say that it won the contract and I can tell you categorically that this is the case with other contracts as well.’

5.9.3 Assistance with Quality Management Audits

Early in the interview cycle, the subject of ISO accreditation and quality system audits was mentioned. This was not one of the original thematic categories and an interview question as shown in Table 3-3 was added. The results of the question are shown in Figure 5-6.

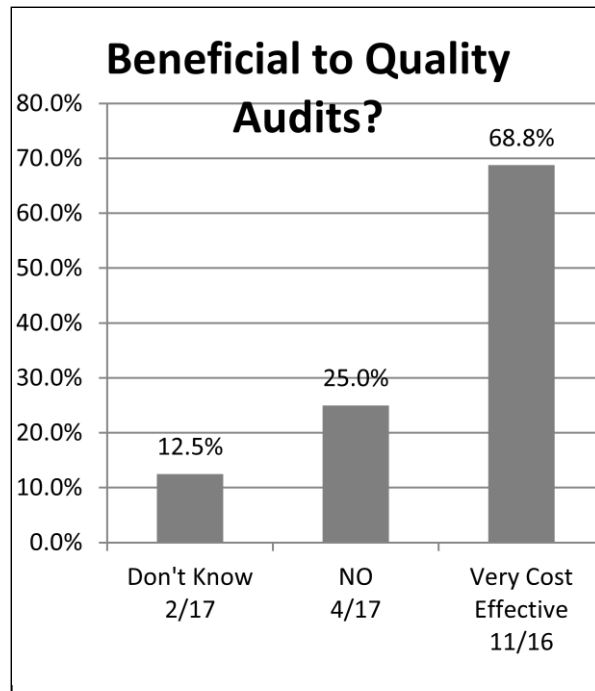


Figure 5-6 Beneficial to Quality Audits?

Participant comments are illustrated by the following sample quotes:

‘Yes. They [the quality system auditors] always cite content, and definitely cite when it is also related to safety.’ Mining[1].

‘We have auditors comment positively on it, when they come, cause we’re certified to 4801 type of quality, and environmental, and obviously we get audited, and we do have comments from the auditors as to the high quality of our induction process. So it may sort of tick a box in their overall auditing, but generally there’s a comment about it being well received.’ HeavyIndustry[1].

‘It also helps us with our quality systems audit at ISO90001. I’ve increased our standard to get us another certification.’ Services[1].

The three of the participants who didn't indicate 'yes', anticipated that they would do so during the next audit: 'No it hasn't and that's only simply because we haven't got to those areas as yet.' Mining[2].

5.9.4 Additional Languages

A theme suggested by The Multimedia Company as being a 'hot topic' was the use of additional languages in multimedia OHSE inductions. The topic turned out to be decidedly 'cold' as illustrated by the opinions in Figure 5-7. Where industrial safety legislative acts were involved, the acts specified that competency in the English language was a requirement for any employees covered by the act.

Approximately one third of the participants (35.3% (6/17)) indicated that poor English reading literacy was a bigger issue to them rather than additional languages. For this reason, multimedia's ability to show things rather than having to rely on reading comprehension was a big advantage.

5.10 WITHIN/BETWEEN INDUSTRY SEGMENTS

The theoretical results matrix (participants vs. coding categories) was scanned axially (rows and columns) by close reading in an attempt to identify any within or between industry sector differences or patterns. As shown by the frequency counts, the participants had a remarkably similar experience – no major differences were detected. The few outliers that existed were in most cases in the 'don't know' or 'too soon to tell' categories.

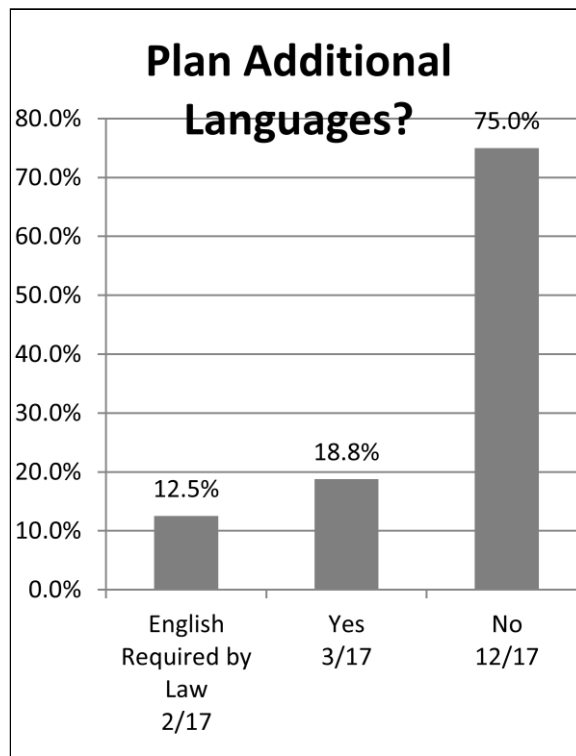


Figure 5-7 Plan Additional Languages?

5.11 TESTIMONIAL

After the conclusion of the main body of the research, the following unsolicited comment was received that neatly highlights the main findings:

‘Our new inductions are fantastic, I know I can leave them with it and go back an hour later with a full assessment done and there have been no break downs. Consequently that saves my and the contractor's time.

Safety benefits - it is current, crosses the new isolation rules, smoking regulations, tagging, reporting of events, etc. which equates to a safer workplace. Admin benefits - the paper work is complete on completion of the induction - no chasing up (another time saver).

I have been asked on a few occasions who produced the DVD, in particular some auditors we had recently. Really complimentary comments. Many contractors remarking that they have had to do many inductions and ours is one of the best and easiest to understand.’

All up, it is great.’

5.12 CONCLUSION

In this chapter, we compared and summarised the predicted theoretical outcomes for each of the theory-oriented research questions against the actual thematic outcomes as discovered from the practice-oriented data in Chapter 4 and the elite interviews. In Chapter 6, we will discuss the implications and limitations of these findings and suggest future research.

Chapter 6 CONCLUSIONS

6.1 INTRODUCTION

The main research question addressed in this thesis asks:

Q0: What factors, forces and influences are driving the technological paradigm shift from traditional OHSE inductions to multimedia?

Chapter 4 presents the results of the practice-oriented research and Chapter 5 presents the results of the theory-oriented/theory-testing research. In this chapter, the implications, limitations and future research opportunities are discussed.

6.2 IMPLICATIONS OF THE PRACTICE-ORIENTED RESEARCH

The objective of the practice-oriented research as stated in Chapter 1.3.1 is:

To contribute to the knowledge base of OHSE and multimedia professionals and practitioners by describing the paradigm shift to the use of multimedia in OHSE inductions.

The research reported in Chapter 4 of this thesis has achieved the objective of adding to the knowledge base of OHSE and multimedia professionals and answers the research question:

Q1.0: In what ways and in what manner are multimedia OHSE inductions being implemented? How does this differ from previous implementations?

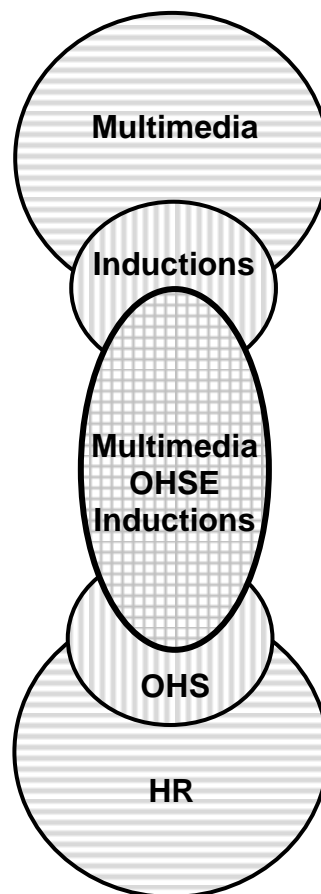
Data concerning the paradigm shift to multimedia OHSE inductions, induction content, multimedia techniques employed, topics addressed and implementation is reported for perhaps the first time in the literature. The ability of multimedia to replace the live trainer, the traditional rigid training schedule, the training classroom and the need for printed training materials is identified and described.

This research represents one of the few times in the literature that usefulness has been investigated in both the pre and post-adoption domains. Using the body of research presented in this thesis, other enterprises and OHSE practitioners may now ask how multimedia OHSE induction technology can be used to propagate their safety message, reduce costs and improve outcomes - and receive an answer. This thesis describes the state of industry practice at this time and provides details of the benefits others have achieved in the areas of pragmatic efficiencies, economies of scale, convenience and flexibility of delivery.

The practice-oriented research presented in this research provides a unique resource for use by educators in planning and assessing OHSE curriculums, for trainers in choosing their methods and for OHSE professionals in planning interventions and future programs. Planners and educators may now investigate the practice and content of workplace multimedia inductions and benefit from the experience of others – how

should the inductions be presented (individually or to a group)? How can inductions be administered? What material should be presented? How long should the induction be? What multimedia techniques may be used? It may also be helpful in alerting students to the use of multimedia in areas other than entertainment, gaming and the creation web sites.

A copy of Figure 1-1 from Chapter 1 is included below to re-introduce the areas of practice investigated in this thesis.



Copy of Figure 1-1 Areas of Practice

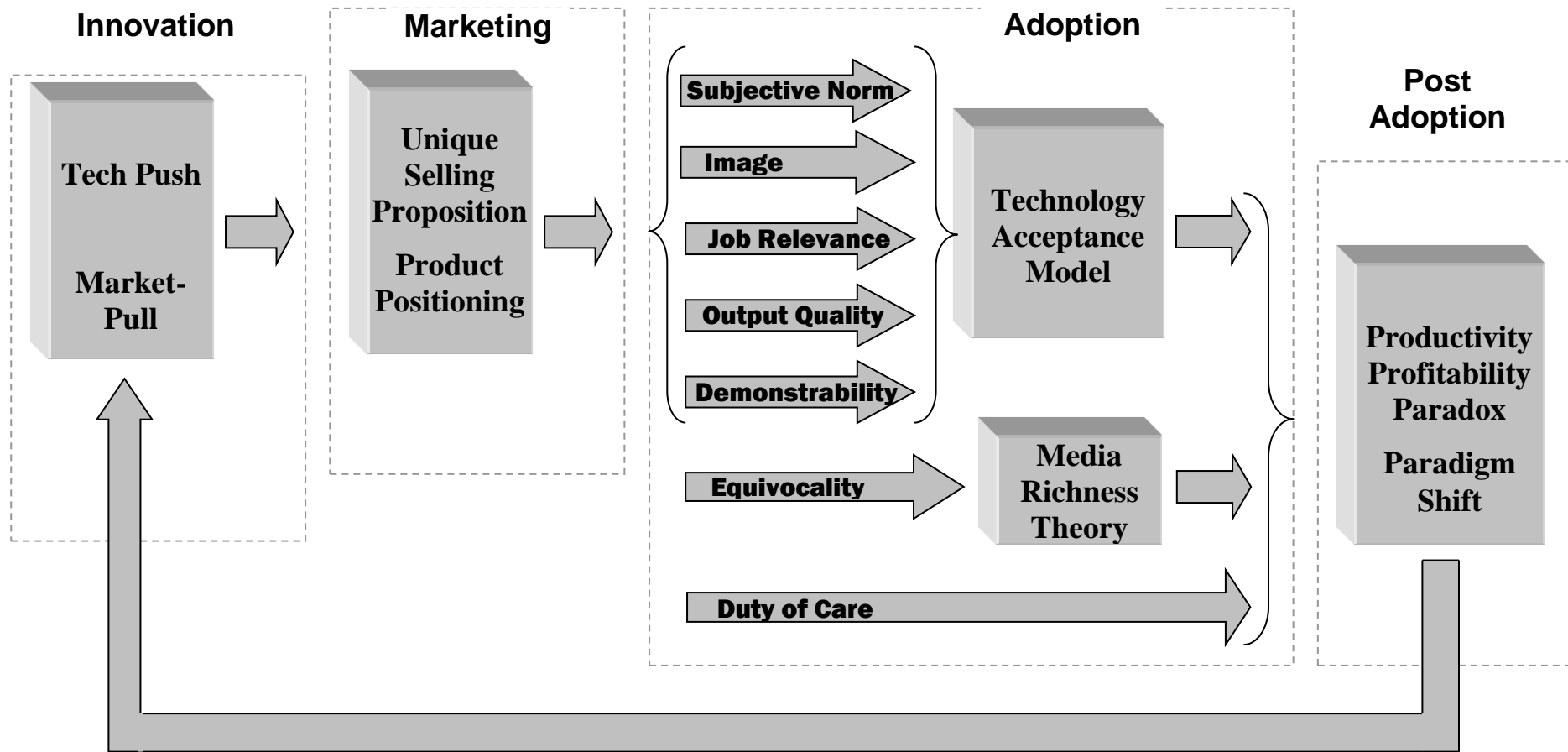
6.3 IMPLICATIONS OF THE THEORY-ORIENTED /THEORY-TESTING RESEARCH

As stated in Chapter 1.3.2, the objective of the theory-oriented/theory-testing research is:

To contribute to the knowledge base of academics, educators and theoreticians by using the data collected in achieving the practice-oriented objective to test theoretical aspects of the paradigm shift to the use of multimedia in OHSE inductions.

The research reported in Chapter 5 has achieved this objective adding to the academic literature the qualitative results of theoretical investigations into a well-defined paradigm shift. The theoretical canvas included the general areas of innovation, marketing, adoption and post-adoption. Within these areas, Technology-Push/Market-Pull theory, USP and Product Positioning marketing theory, TAM/TAM2 adoption theory, Media Richness Theory, Duty of Care influences, PPP theory and Paradigm Shift theories were investigated.

A copy of Figure 1-2 from Chapter 1 is included below for easy reference.



Copy of Figure 1-2 Theoretical Framework

6.3.1 Technology-Push/Market-Pull Theory Implications

The findings in this research as reported in Chapter 5.2 add to the body of theoretical Technology-Push/Market-Pull literature and answer the research question:

Q2.0: In what ways and to what extent have Technology-Push and Market-Pull forces been factors in the multimedia OHSE induction paradigm shift?

Some authors (Walsh, Kirchhoff, and Newbert 2002; Bower and Christensen 1995; Christensen 2007), posit the push of a new technology as being the force behind disruptive change. In this research it was shown that in contradiction The Multimedia Company was pulled to OHSE inductions. This contradiction can be reconciled by arguing that while at the time of the study, multimedia was not a new technology, it was a new technology as far as OHSE inductions were concerned. Mixed models of the push-pull duality (Klang 2006; Bernstein and Singh 2004; Howells 1997) have appeared which aim to develop a better understanding of the innovative process. It was also shown that technological aspects decreased with time.

It is recommended that in considering the implementation of multimedia in OHSE inductions, the new adopter would benefit from concentrating less on the ‘media’ (technology) and more on the ‘message’ (content). Simple, cost effective multimedia techniques were effectively and more commonly used by the participants than such higher cost techniques as 3D human animations. The aim of inductions is to provide the inductees with consistent, unequivocal information, not dazzle them with science.

6.3.2 Marketing Theory Implications

The findings in this research as reported in Chapter 5.3 add to the body of theoretical Marketing literature and answer the research question:

Q3.0: In what ways and to what extent have USPs and Product Positioning arguments been influential in the adoption of multimedia OHSE inductions?

It was shown that USPs played no role in the marketing phase. This may be due to the perceived lack of ‘competitors’ and/or competitive technologies. The USP was originally formulated to describe marketing approaches in highly competitive markets such as beer and laundry powder. Being unique avoids direct product comparison and makes other products adopt a ‘me too’, ‘follow the leader’ position. With few or no perceived competitive forces, being unique is not a requirement for success (‘...the only game in town’).

Product positioning against video and examples of what other enterprises were doing (image and the ‘herd’) were pivotal in the purchase of the inductions. With no point of reference to competitors, the safest path is to follow the lead of others. One bird feeding on a patch of lawn draws others.

The participants’ lack of emphasis on cost savings and efficiency as adopting factors was not anticipated. These factors seem to stand out at first appraisal as important benefits. However, on the participants approach to management for the second tranche

of inductions, cost savings and efficiencies were used as arguments to higher management as justifications. That is, in the first instance the adopters did not adopt multimedia inductions for cost or time saving reasons but then used these arguments to convince higher management to continue investing.

It is therefore recommended that OHSE staff in attempting to convince their companies to invest in multimedia OHSE inductions employ product positioning with the use of copious demonstrations of what the ‘herd’ is adopting in the first instance, and cost and time savings from there on out.

6.3.3 The Technology Acceptance Model Implications

The findings in this research as reported in Chapter 5.4 add to the body of theoretical TAM/TAM2 literature and answer the research question:

Q4.1 To what extent have multimedia OHSE inductions been easy to use?

Q4.2 In what ways and to what extent have Subjective Norm, Image, Job Relevance, Output Quality and Demonstratability been influences in the adoption of multimedia OHSE inductions?

Q4.3 What is the intent for future adoption of multimedia OHSE inductions?

This research adds to the body of theoretical TAM/TAM2 literature. PEOU, Demonstratability, Output Quality, and Job Relevance were all found to positively support adoption. Considering that inductions might be considered a rather mundane

OHSE task, it was surprising that Image was an influence in adoption. Image in terms of being seen as or comparable to industry leaders and nurturing the image of a caring and responsible employer were both mentioned in the interviews.

Subjective Norm was not found to be a positive adoption factor. This supports the TAM/TAM2 position that Subjective Norm will only be an influence when adoption is mandatory. Legislative DOC requirements may at first appear to be mandatory, but the participants were vague about their responsibilities under the various Acts and did not appear to view the legislation as specifically mandating inductions - let alone, a particular type of induction.

The ease with which demonstratability could be shown (adoption by others) was a pivotal influence in adoption. The Multimedia Company routinely used clips of multimedia inductions from other companies as a sales tool, handout (on CD) and on their web site. After an initial meeting, The Multimedia Company marketers were often asked back (often multiple times) to present their sample clips to higher management.

6.3.4 Media Richness Theory Implications

This research adds to the body of theoretical MRT literature and answers the research question:

Q5.0: In what ways and in what manner is multimedia better able to dispel uncertainty and reduce equivocality as compared to face-to-face delivery of OHSE inductions?

The ability to rapidly inform a large target audience, to reduce equivocality and to provide consistency of induction content over time was a very strong factor in adoption. Strong enough for the participants to replace their traditional face-to-face classroom training with multimedia. This preference appears to be in contradiction to hierarchy of delivery modes posited by the MRT.

Multimedia does not appear in Table 2-2 (the MRT hierarchy of delivery modes). As discussed in Chapter 2.6.4, multimedia encompasses attributes of both video recording and web sites. It should therefore replace web sites and be ranked above video recordings. Only telephone and video conferencing would rank higher – and for what reason? If media richness is defined as the ability of a media to change understanding within a *time interval* (Daft and Lengel 1986, p. 560), then multimedia would only be ranked below telephone and video conferencing in richness because of the lack of rapid feedback capability. However, consider the question of *time* in the case of a General directing an army or a President informing his country. It would be impractical to attempt to change the understanding of each member of the target audience using some form of face-to-face conferencing. In OHSE inductions, as in the above example, the goal is a change in behaviour (with or without a change in understanding). In the case of a directive of ‘Do not smoke in the work place’, the value of immediate and universal feedback is minimal.

6.3.5 Duty of Care Implications

This research adds to the body of theoretical DOC literature and answers the research question:

Q6.0: In what ways and to what extent has DOC been a factor in the adoption of multimedia OHSE inductions?

While legislative DOC is a factor in every state of Australia, it surprisingly was not found to be a strong influence in adoption. A sense of corporate DOC to employees was found to be a much stronger influence in adopting multimedia for OHSE inductions.

The use of multimedia systems as an archival tool to record and document OHSE training was a strong factor in adoption. A Learning Management System (LMS) associated with the inductions allowed the management to record the dates and details of inductions. Where the requirement for inductions was spread over the enterprise, the system allowed the managers to rapidly determine if an employee was certified to work in a particular area. Where re-induction was mandated on a calendar basis or after a specified absence from site (for example for annual leave), the systems could automatically flag up employees needing re-induction. From an enterprise perspective, the LMS systems provided an invaluable service in the case of government or insurance accident investigations where breaches of OHSE legislation or safe working practices were suspected. The employers were able to provide proof of what induction materials were provided to the employee(s) and the employee's performance in understanding them.

6.3.6 Profitability-Productivity Paradox Conclusions and Implications

This research adds to the body of theoretical PPP literature for IT in general and multimedia in particular and answers the research questions:

Q7.0 Does the adoption of multimedia OHSE inductions support or refute the PPP?

Sub-questions:

Q7.1 Have multimedia OHSE inductions been cost effective? How has this been determined?

Q7.2 Has multimedia affected the efficiency of inductions?

Q7.3 Were ‘profits’ traded away before hitting the bottom line?

Multimedia as employed in OHSE inductions was found by the adopters to be cost effective with cost investigations being limited to basic cost versus throughput calculations.

Multimedia as employed in OHSE inductions was also found to improve induction efficiency. The adopters were able to eliminate or severely reduce the costs and times associated with trainers, the training materials, training rooms and the training schedules.

This research supports the PPP in general by noting that when asked, not one of the participants reported a decrease in their next year’s section budget based on the cost and

time savings gained from the use of multimedia in OHSE inductions. No decrease in section costs with the additional cost of the new multimedia inductions equals a higher, not lower, section budget. The adoption of multimedia OHSE inductions may therefore be seen as hitting the bottom line in the wrong column and decreasing profitability. However, the Redistribution explanation of the PPP (redistributed of profits/benefits before they hit the bottom line as described in Chapter 2.7.3.5) was supported by the research. Physical resources such as training rooms were re-used for other purposes and OHSE professionals who were tied down giving inductions could now apply that time to other duties more suited to their job description and qualifications (e.g. accident investigations, safe working practices, etc.). This indirectly (rather than directly in the production of inductions) increased the productivity of the OHSE section.

The research also supports the Information Productivity® (transactional efficiency) alternative to the PPP as described in Chapter 2.7.3.7. The participants stated that multimedia improved the efficiency of their inductions. In many cases the participants could not have achieved the necessary number of inductions in the available time without the use of multimedia.

Why have similar findings - multimedia being cost effective, increasing production, freeing resources for other uses and improving transactional efficiency - not been previously detected and reported? There are several possible explanations but one of the most obvious questions to ask is who has done the research and what did they examine? On the whole, the PPP research has been carried out by economists studying statistics rather than by IT professionals reporting on practice. It is hoped that this research from within IT will help redress this imbalance. In the case of what did they examine,

economists would not have recognised as valid the back of the envelope calculations of cost effectiveness favored by the participants of this study, nor the method of determining the redistribution of profits before they hit the bottom line by asking if the next year's budget had been reduced.

A second answer to the question may be found in the nature of IT expenditure. What the 1964 dollar bought in blank punch cards can hardly be compared to what the 2009 dollar buys in network access – both are IT expenditures but with hugely differing impacts on potential productivity and profitability. Willcocks and Lester (1999, p. 20) are one of the few to address this problem and point to the shifts in eras (mainframe/mini to PC to network to internet to cloud?) as making the assessment of IT investment success particularly prone to confusion. In this, Strassmann (2004b, 2001a, 2004c, 2004d) may be right – companies use IT to reduce transactional costs and as the nature of transactions change, so does the expenditure.

A third possible explanation may be found in the PU of multimedia – for what purpose is multimedia perceived to be useful? Multimedia curriculums are heavily targeted toward games, e-commerce and entertainment. Hopefully this research will broaden the educational outlook on the possible scope of multimedia applications.

6.3.7 Paradigm Shift Implications

This research adds to the body of literature related to paradigm shift and answers the research question:

Q8.0 Has the change to multimedia OHSE inductions been viewed as revolutionary? If so, what factors proved powerful enough to cause the firm to ‘take the leap’?

This research does not support the disruptive technology theory behind paradigm shifts as described in Chapter 2.8.2. The technology (multimedia) was not the revolutionary activist, it was the revolutionary application of multimedia that powered the paradigm shift. This view is supported by Klang (2006) who notes that the revolution stems not wholly from innovative technology but rather from the innovative application of technology. This can be further illustrated by the decline in the level of multimedia technology employed over time as described in Chapter 5.9.1.

The powerful incentives behind the great leap over the paradigm shift chasm in this study were improved efficiency, image and output quality. While cost is cited as an incentive for adoption it was not identified as an incentive for change. This makes sense in the context that the primary purpose of OHSE is to save lives and reduce injuries not save money. Companies often state (and mean it) that production must take a backseat to safety.

When examining disruptive technology and the Internet, Klang (2006) notes that the existence of rapid change is both true and false. In every case addressed, ‘...the innovation lays not so much in the technology but rather in its adoption.’ (Klang 2006, p. 221).

As discussed in Chapter 5.7, cost effectiveness and time efficiencies were the powerful incentives that encouraged the participants to ‘take the leap’ (Von Hippel 1986; Moore 1991). As these factors account for two of the three ‘triple constraints’ of business (time, cost, resources), it is understandable that together they present strong, persuasive incentives to adopt.

6.4 LIMITATIONS OF THE RESEARCH

6.4.1 Extensibility

Because of the generally narrow field of investigation, case study research is often prone to criticism as to its general applicability (Yin 2003b). As described in Chapter 3.7, in this research case study participants within the same industry were compared to case study participants in different industrial domains. Both the practice-oriented and theoretical results were examined to determine if there were any within or between industry sector differences. None were detected. In the sense that there were no significant differences between the findings within industries or between industry segments, the research can be said to be generally extendable to other companies in the same industrial sectors. Further, because of the similarity of findings in the quite different industrial sectors it would not be difficult to justify the extension of the findings to other, more diverse industrial sectors.

6.4.2 Limitation of Case Study Participants

The findings are limited to clients of a single multimedia supplier (as rigorously described and justified). Criticisms of this limitation are valid and we look forward to

evidence from other sources. However, considering the elite nature of the case study participants and barriers to access, one is tempted to misquote Dr. Johnson and say that while ‘It may not be done well; you are surprised that it is done at all’.

The research was limited by the number of participants that could be included. The number of participants was limited by geography and the cost of travel – only companies within the Australian mainland were included in the study.

6.5 SUGGESTIONS FOR FUTURE RESEARCH

Several areas for future research suggest themselves and are described in the following sections.

6.5.1 IT Project Justifications

Every IT project undertaken in a major enterprise is the subject of an economic evaluation. In these archives lurks a repository of economic justifications just waiting for an interested researcher to compare them to actual outcome (something that within the experience of the author is seldom if ever done). If the proposals were justified on the basis of improved profitability or productivity, the projects could prove invaluable in confirming or refuting the PPP. If justified on the basis of improved transaction efficiency, the projects could be equally valuable in confirming or refuting the Information Productivity® (transaction efficiency) proposition.

6.5.2 Other Countries

Other countries have different outlooks on OHSE – how do they compare in terms of DOC? What are other Western countries doing in the OHSE area? The Multimedia Company is currently enjoying success in the Middle East (especially the UAE) and S.E. Asia. This trend may indicate that the DOC concept is spreading out of the First World. Investigations in other countries conducted along the same line as this thesis would assist in determining the general applicability of the specific findings reported here.

6.5.3 Other Uses for Multimedia

Are cost effectiveness and the other benefits of multimedia as employed in OHSE available in other implementations of multimedia? Excluding entertainment, e-commerce and educational e-learning, there are a wealth of other, possibly cost effective, multimedia applications that have not been investigated. These include 3D visualizations and fly-throughs (a number of Australian companies specialize in this area), multimedia for tenders (interactive options, staging, ascetics, etc.), multimedia for CVs (students in the author's classes have recently been told to 'Send me a 5 minute video/show reel of yourself and some of your work'), multimedia for court/legal proceedings (The Multimedia Company has done a number of these), multimedia for hotel/venue safety (giving the alarm sounds, showing the exits, etc.), medical multimedia (*The Lancet* among others has been publishing some articles), and so forth. Supporting evidence from other uses of multimedia would further support the findings and usefulness of research reported here.

6.5.4 Troughs of Productivity

Circa 1980 has been identified as the peak of the mainframe/minicomputer era with 10 million users (Strassmann 1997; Moschella 1997; Willcocks and Lester 1999). Circa 1991 has been identified as the peak of the stand-alone PC era with 100 million users (Strassmann 1997; Moschella 1997; Willcocks and Lester 1999). Circa 2008 may possibly be the peak of Server Oriented Architecture era with 1,000 million users (with the mobile or 'cloud' era to come?).

Each of these peaks is temporally associated with a corresponding trough in productivity as shown by Figure 2-7. Why is this so? While a more suitable target for economic rather than IT research, it is curious that the question has not previously been raised in respect of the PPP.

6.6 COMPLETION

As demonstrated and summarised by the preceding sections and chapters, this research has therefore contributed to both the practice-oriented and theory-oriented /theory-testing bodies of knowledge associated with the general research question:

Q0: What factors, forces and influences are driving the technological paradigm shift from traditional OHSE inductions to multimedia?

APPENDIX A DEFINITION OF TERMS

Diffusion of Innovations

Theory Theory by Rogers (1962) that identified five categories of adopters – innovators, early adopters, early majority, late majority, and laggards

Disruptive Technology..... Technology that is revolutionary and replaces rather than evolves its predecessor

DIT Acronym for the Diffusion Innovation Theory

DOC Acronym for duty of care

E-Learning An umbrella term meaning use of electronics in learning (Netlingo.com)

Induction A formal introduction or entry (*Compact Oxford English Dictionary of Current English, 3rd Ed. 2005*)

Isolation..... See Tagging

IT IT is used in this thesis in all cases where similar terms may have been used in the literature e.g. in place of Information and Communications Technology (ICT), New Information Communication Technology (NICT), Computer and Communication Technology (C&CT) and so forth.

JSA-JHA Acronym for Job Safety-Hazard Analysis. JSA-JHA is a system of evaluating the risks associated with a task and the measures that will be taken to address them. A new JSA-JHA (even for the same task) is usually handwritten

and often done daily prior to commencement of work.

Labour ProductivitySee productivity

LPAcronym for Labour Productivity (see productivity)

MarketingPresentation of a product to the market. Used as
synonymous with advertising in this research

Market-PullProducts developed in response to market demand rather
than just technological innovation (for example flat screen
television)

Media Richness Theory.....A theory that posits that the more ambiguous and
equivocal the possible outcomes of a communication, the
richer the format of the media must be (Daft and Lengel
1986)

MFP.....Acronym for Multifactor Productivity

MRTAcronym for Media Richness Theory

Multifactor Productivity.....When actual economic production is compared to that
predicted by the production function, there is a residual.
There is generally more output than can be accounted for
by the inputs. This residual (also known as the Solow
Residual) is called Multifactor Productivity (MFP). A
change in MFP reflects a change in productivity efficiency.
In theory, MFP is a better measure of efficiency than LP as
it measures how well the two facets of production (capital
and labour) are working together. MFP is often taken as
the measure of innovation.

MultimediaA computer-based method of presenting combinations of

text, images, graphics, animation, streaming audio or video, and so on. Modern multimedia features an emphasis on interactivity (Daft and Lengel 1987).

OHSE Acronym for Occupational Health, Safety and Environment

OHSE Induction An induction containing general, enterprise wide OHSE information - for example corporate environmental policy

Paradigm Shift..... A fundamental change in the usually accepted approach, procedure or manner of thinking (*Compact Oxford English Dictionary of Current English, 3rd Ed. 2005*).

Perceived Ease of Use..... The degree to which a technology is considered to be easy to use. Along with its twin Perceived Usefulness, it is one of the major TAM/TAM2 constructs.

Perceived Usefulness The degree to which a technology is considered to be utilitarian. Along with its twin Perceived Ease of Use, it is one of the major TAM/TAM2 constructs.

PEOU Acronym for Perceived Ease of Use

Permits to Work A system of approvals for any work that is deemed inherently dangerous. Permits usually include 'hot work' (welding, grinding, thermite), working at heights, working in 'confined spaces' (vessels, tanks, pipes, enclosures) and excavation (digging below a certain depth)

PPE..... Acronym for Personal Protective Equipment as may be required to be worn. PPE may include clothing such as long sleeved shirts with a collar, reflective vests, hats, hard

hats, safety glasses, steel-toed lace-up boots, gloves,
breathing apparatus and so forth.

PPP Acronym for the Productivity-Profitability Paradox

Practice-oriented Practice-oriented research is research that is aimed at
contributing to the knowledge of specific practitioners
responsible for a specific practice. Practice is used in the
execution rather than in the rehearsal sense.

Product Positioning A theory of advertising: A product is presented with an
image and in relation to its peers in such a manner as to
dispel confusion and perceived risk (*Netlingo the Internet
Dictionary*)

Production Function A mathematical model describing an economy. Output is
obtained as the result of investment in traditional capital
plus labour capital. Adding more barges or slaves will
build more pyramids. The affect on productivity of adding
either type of capital is well known to economists.

Productivity Productivity or Labour Productivity (LP) is usually
measured in units of output per man/hour

Productivity-Profitability

Paradox The economic paradox that investment in IT does not
produce corresponding improvements in profitability or
productivity.

PU Acronym for Perceived Usefulness

Subjective Norm Subjective Norm is the person's perception of what most
people who are important to him think about his

performance or non-performance of a behavior. It is one of the TAM/TAM2 major constructs.

Tagging Systems that identify the state of non-operational plant and equipment. Tagging systems include ‘out-of-service’ (broken, faulty), ‘danger’ (hazard) and ‘isolation’ (removal of drive power).

Take 5 A system for addressing the risks associated with a new task and how they will be addressed. The worker(s) are asked to step back and ‘take 5 minutes’ to work through the risk assessment.

TAM Acronym for Technology Acceptance Model

Technology Acceptance

Model The most widely known and accepted model of the uptake of technology (Davis 1986)

Technology-Push Products marketed mainly on the basis of innovative technology rather than market demand (for example the first laser devices)

The Multimedia Company ... An alias for the multimedia company whose clients form the units of this research.

Theory of Planned Behavior Extension of the TRA by Ajzen and Madden (1986) to take into account compulsory factors

Theory of Reasoned Action . Asserts that the decision to adopt a technology) arises from intention arises from attitudes regarding the consequences of the behavior and attitudes regarding social image (Ajzen and Fishbein 1980)

TPBAcronym for the Theory of Planned Behavior

TRA.....Acronym for the Theory of Reasoned Action

Unique Selling Proposition ..A theory of advertising that posits that adoption is
mediated through exposure to a strong, product related
propositions that cannot be met by competitors (Davis
1989; Davis, Bagozzi, and Warshaw 1989)


USPAcronym for Unique Selling Proposition

APPENDIX B SAMPLE THEMATIC COLUMN

	Media Richness - Consistency
DiverseGoods[1]	<p>... by having this group induction CD at least we can be assured of consistency.</p> <p>...and put simply one of the first things was that we want to reduce the time, the face-to-face time. And we've managed to achieve that. And by the same token, we wanted to get specific information out, as you just mentioned, where – and we don't want it to deviate or be different when a different person does the same thing. We wanted that consistency and for that reason this was perfect.</p>
Agriculture[1]	<p>..., also the other benefit was consistency across the group. Even though there's a script that you were meant to deliver, each person would emphasise and do things differently whereas now, we break the induction in three parts, we stop it and they give a little test, and then they go onto the second part, do another test, and then the final part, and there's a demo of PPE at the end and what have you, that we hand out and put on. So that certainly reduced the time, it certainly improved the consistency across Australia throughout the sites in South Australia right up to Queensland.</p>
Mining[1]	<p>I think the main thing is to ensure everyone got the same information. Consistency - So one of the larger things,</p> <p>I think it comes back to standardisation a bit. Because if you've got one facilitator and then another facilitator, they may not know of the same examples to back up a product. By using images through a multimedia solution, the person who is sitting in there looks and can see the picture and that's really important for safety.</p> <p>So this information is consistent, and with the multimedia solution it's always going to be up to date.</p> <p>Consistency is absolutely it and you know just the message itself is standard. Now in any physical presentation there will always be variants, differences and nuances depending on whether you had a good hair day or bad hair day and there will be certain other emphasis, and your whole main messages can get watered down depending on interaction. We didn't want that, we want exactly the same message.</p>

APPENDIX C PRE-INTERVIEW PACKET

C.1 INVITATION TO PARTICIPATE IN RESEARCH



www.murdoch.edu.au

Invitation to Participate in Research

Adoption of Multimedia OHSE Site Specific Inductions

Background and Aim of the Study
As one of a growing number of Australian firms that have adopted multimedia for OHSE, site specific, inductions, you are invited to participate in this research programme. The aim of the research is to investigate the adoption and implementation of multimedia in this field.

What Does Your Participation Involve?
Participation in this study involves a single, approximately 60 minute, face-to-face interview. Prior to the interview, an agenda will be provided listing the areas for discussion including the reasons for adoption, implementation and outcomes. Any follow-up questions will be submitted via email.

Who Will Conduct the Research?
Rodger Wright MSc, MACS, PCP (rodgerwright@cell-media.com 0419885337) is conducting this PhD level research under the supervision of Dr. Tanya McGill (T.McGill@murdoch.edu.au 08 9360 2798) and Assoc. Prof. Dr. Lance Fung (L.Fung@murdoch.edu.au 08 9360 7586) of Murdoch University's School of IT.

Anticipated Benefits
The anticipated benefits of this research include determination of best practice, identification of instances of successful implementation and determination of cost-benefit. Each participating company will receive a copy of the completed research.

Participation and Confidentiality of Data
Participation in this research is entirely voluntary. There are no consequences for declining to participate. Consent may be withdrawn at any time without the need for justification.

The interview will be recorded and transcribed. A copy of the recorded interview will be provided upon written request. After completion of transcription, the interview recording and any information connecting the transcription with the interviewee or company will be destroyed. No direct association between the data and the interviewee or the company will be retained or made in any publication arising out of this research. Any information provided will be treated as confidential and will not be released to any third party unless required to do so by force of law.

Risk Assessment
There are no specific risks anticipated with participation in this study.

Questions
My supervisors and I, or alternately Murdoch University's Human Research Ethics Committee (08 9360 6677), would be pleased to answer any questions concerning this research.

Acceptance
Acceptance can be indicated by completing the accompanying consent form.

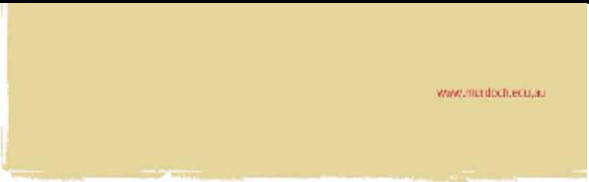

I look forward to hearing about your company's multimedia OHSE experience!

This study has been approved by the Murdoch University Human Research Ethics Committee (Approval No. xxxx/xx)

Page 1 of 1

CRICOS Provider Code: 001251
ABN: 61 516 368 313

C.2 INTRODUCTORY PERSONALISED LETTER



www.murdoch.edu.au

.....
.....
.....
.....

Dear,

RE: Adoption of Multimedia OHSE Site Specific Inductions Research

After founding the company Cell-media, I embarked on a programme of MSc and now PhD level research into the adoption of multimedia for OHSE inductions. In respect of this, I am now organising a series of interviews with top Australian enterprises in several industry sectors.


Mr. Steve Clarke of Cell-media has identified your company as one of the leaders in the adoption of multimedia for OHSE purposes. I would like to invite you to participate in this research as described in the attached material. It will only take an hour or so of your time and the information gained will be shared on a completely anonymous basis between the participants.

I will be contacting you shortly to discuss any questions you may have and to hopefully arrange a date and time for an interview with you.

Yours faithfully,


Rodger Wright

+61 0419885337
rodgerwright@cell-media.com



CRICOS Provider Code: 00125/
ABN 51 615 369 313

C.3 CONSENT FORM

 Murdoch UNIVERSITY	Consent Form www.murdoch.edu.au
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Adoption of Multimedia OHSE Site Specific Inductions

1. I agree voluntarily to take part in this study.
2. I have read the Information Sheet provided and understand the purpose of the study.
3. I understand that I am free to withdraw from the study at any time without needing to provide a reason.
4. I understand that the interview will be recorded and transcribed and that upon written request a copy of the recorded interview will be provided.
5. I understand that after transcription of the interview any information connecting the transcription to me or my company will be destroyed. I understand that neither my company nor I will be directly identified in the stored data or any publication arising out of the study.
6. I understand that any information provided by the company will be treated as confidential and will not be released to any third party unless required to do so by law.
7. I understand that there will be no reimbursement or remuneration for participation.
8. I understand that while the anticipated benefits are likely, they may not occur.

Signature of Participant: _____ Date:/...../.....
(Name)

Signature of Investigator: _____ Date:/...../.....
(Name)

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CRICOS Provider Code: 00125J
ABN 61 616 369 313

C.4 SAMPLE QUESTIONS

Adoption of Multimedia OHSE Site Specific Inductions

In this research, I am particularly interested in discovering what brought your company to use multimedia, how this changed the manner in which inductions were done, and what benefits/problems have resulted. Prior to the interview, please spend a few moments to prepare any relevant facts and figures that may be available.

1. What multimedia marketing propositions did you find convincing?
2. How do you see multimedia positioned against other methodology?
3. What OHSE induction methodology was used prior to multimedia?
Positive/Negative attributes?
4. How is multimedia used in the induction process:
 - 4.1 In groups? Individuals?
 - 4.2 On-line? In the company's premises? Outside premises?
 - 4.3 Who is inducted? (Staff? Contractors? Visitors?)
 - 4.4 Who administers/supervises the inductions?
5. How easy is it to use multimedia?
6. Why has multimedia replaced face-to-face training?
7. Has multimedia provided any improvements in Production? Profitability? Has multimedia been cost effective?
8. As a result of using multimedia have:
 - 8.1 OHSE Budgets been reduced? Avoided being expanded?
 - 8.2 Department restructuring or personnel reassignment occurred?
 - 8.3 Any non-financial benefits been realised?
 - 8.4 Can any improvements be seen in the 'bottom line'?
9. Has multimedia provided any problems or had negative results?
10. Has the change-over been evolutionary or revolutionary? What perceived benefits induced the company to change?
11. Are there any plans to expand the use of multimedia for other uses?
12. Has use of multimedia been of assistance with Quality Management or ISO accreditation?
13. Have there been any problems with scripting?

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